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Indeterminate Lighting Contracts

The suggestion for an indeterminate form of street-lighting contract which arises from the experience of the Watertown (Wis.) Gas & Electric Company and the Electric Company of Missouri, mentioned elsewhere in this issue, contains features that are worthy of serious consideration. Where the duration of a street-lighting contract is limited by statute it would, of course, be necessary to secure new legislation before the indeterminate principle could be applied in this way. But if the parties most concerned should agree upon the desirability of change, the legislation would follow. Under the usual form of street-lighting contract a material investment is made by the company, partly in consideration of the fact that the arrangement is for a term of years and partly in the expectation that, irrespective of the actual period named in the bond, the arrangement will be continued at satisfactory rates and indefinitely. Without such an expectation the investment should be amortized if the most careful accounting requirements are to be observed. In the degree in which the expectation of renewal is lessened the investment of funds without amortization becomes a speculation. It is not to the interest of either the company or the city that all or any part of an investment of this kind shall be wasted deliberately. It is to the interest of both that it shall be safeguarded. If the investment is lost, the amount of loss becomes a charge upon the property and generally a charge that ultimately falls in some way upon the consumers. If the investment is protected, it is so much tangible property of which the community gets the benefit. Under an indeterminate form of contract no serious waste of capital of this character could take place. The city would have the right to cancel the contract upon payment of fair value. Non-renewal of the contract would not mean loss as it may do under the usual conditions that obtain now.

The Control of Monopoly

A report of the committee on telephone and telegraph rates and service, presented before the National Association of Railway Commissioners at the recent annual meeting, is in large part an argument for properly controlled monopoly rather than competition in public utilities. The pure truth of this economically sound position should render argument of it unnecessary; but when we see cities like Cleveland resort to competition, though complete regulation is assured through a state commission, it is evident that pains must still be taken so that the public shall want the wiser method to be adopted. The words of the committee are: "There are demagogues and others who are not true students of economy and believers in efficient regulation who believe that open competition acts as a sword of fear and thereby assists in the maintenance of low rates. The sanction of competition in the local public utility field is but an invitation to final economic loss." The chairman of this committee was Mr. Watson, of the Oklahoma commission. New wine is not to be put in old bottles, but old truths may be put in new words. Competition is undesirable because it is not permanently effective. If the facilities of two plants are available to the public, each is duplicating the service of the other. A duplication of service means a duplication of investment. A duplication of investment means that the public is called upon to pay interest on both investments. Each one clamors for business, for street rights, for profits. Because any other result than the absorption of one plant by the other is uneconomic the most rigorous commissions recognize that consolidation is the inevitable end. They therefore discourage competition. Even if it were possible to have two plants operating in separate districts of a community without competition, the best service for the public would not be obtained by this means. Two plants, with separate organizations, separate overhead expense and separate physical structures, cannot be operated as economically as a single large plant of capacity equal to the two. The fear of competition may have been a spur in the days of haphazard relations between the public and the utilities. This has been succeeded by regulation and, we believe, a very general desire that regulation shall be effective. To make it effective and wholesome is a company duty as well as a public duty.

Potential Over Series Insulators

When a series of similar suspension insulators are made up in a string, supporting a high-tension conductor, it might at first thought be supposed that the voltage would fall uniformly along the string, and that the difference of potential across each insulator would automatically become the same. Observation shows, however, that such is not the case, and that the difference of potential across the first insulator, nearest to the line conductor, may be two or three times as great as that across the last insulator in the series. The reason for this undue proportion of stress on the first insulator is that the electric flux passes not only through all the insulators in series but also laterally to ground through the air. The condition is similar to that of a leaky conducting line, where the current in the first kilometer is the greatest and it falls off toward the distant end of

the line. It becomes possible, however, by grading the insulators to restore uniform potential differences across them in spite of this lateral flux leakage. Some tests in this direction are reported by Messrs. J. L. Brenneman and Harold M. Crothers in an article appearing elsewhere in this number. It appears that the potential difference across the first of a series of six insulators was nearly double that across the last. The influence of corona over the first insulator was, however, toward diminishing this disparity. The observations reported indicate the difficulty which exists in measuring the potential at any given insulator in the series. The mere approach of a wire to the point whose potential is to be determined has the effect of changing to some extent the entire potential distribution in the system.

Magnetic Habits of Alloy Steels

It is generally recognized that magnetic retentiveness, or the magnetic quality which goes with permanent magnets, is associated with the mechanical hardness of steel. If steel is very soft, yielding easily to abrasion, it is easily magnetized and also easily demagnetized, so that it is unsuitable for the production of permanent magnets. On the other hand, hard steel, especially hard steel containing a certain amount of chromium, tungsten or other substances in alloy, is likely to make good permanent magnets.

On Ewing's theory of magnetism, the connection between mechanical and magnetic hardness is accounted for by assuming that each individual molecular magnet entering into the structure of iron or steel has a certain amount of friction opposing rotation on its pivot and due to the mechanical hardness of the material. Hard steel, therefore, resists being magnetized or having its individual molecular magnets aligned, but once magnetized the same pivot frictional resistance tends to prevent demagnetization when the magnetizing force is removed. Yet it is not permissible to carry the assumed connection between mechanical and magnetic hardness too far, if only because of chemical complications. The same degree of hardness may exist in two samples of the same steel which have been subjected to different thermal treatment, and yet the magnetic hardness will be very unlike.

In a paper read before the American Society for Testing Materials, Mr. J. A. Mathews proposes, as a measure of the magnetic hardness of a sample of steel, the ratio of coercive force to residual flux density, a ratio which is a mere numeric on the conventional theory of magnetic-unit dimensions, and which comes out between 0.15 and 0.7 per cent in the cases presented. That is, the demagnetizing force necessary to apply to a sample in order to demagnetize it completely varies between 0.15 per cent and 0.7 per cent of the residual flux density or remanence at zero magnetizing force. The larger this numerical ratio, the harder the material is to demagnetize and the harder its magnetism. The author shows that in the cases of a number of alloy steels water-quenching produces greater mechanical hardness than oil-quenching, and yet the magnetic hardness is greater with the oil quenching. Moreover, a steel which after quenching without annealing might show the same mechanical hardness as a sample of the same material quenched and unannealed might show considerably less magnetic hardness, the mechanical hardness being judged by the Brinell ball test and the Shore scleroscope test, while the magnetic hardness was judged by the above-mentioned ratio of coercive force to remanence. The paper is interesting on account of its wealth of statistical material. It shows, among other things, that the "percentage remanence," or ratio of remanence to maximum cyclic flux density, varies much less with heat treatment than does the magnetic hardness. It is known that in varying ranges of cyclic magnetization in iron or steel the percentage remanence remains approximately constant. A conclusion which may safely be drawn from the paper is that magnetic hardness depends upon other things besides mechanical hardness.

New A. I. E. E. Standardization Rules

On Dec. 1, 1914, the new Standardization Rules of the American Institute of Electrical Engineers became effective. We congratulate the Institute upon the achievement. The new edition presents a marked advance over the preceding edition of 1911. It covers nearly 100 printed pages and numbers 568 sections. It has called for co-operative work and agreement with several engineering bodies outside of the A. I. E. E., namely, the International Electrotechnical Commission, the Bureau of Standards, the Illuminating Engineering Society, the Institute of Radio Engineers, and the American Society for Testing Materials, all of which bodies are specifically referred to in the way of mutual agreements. Large as this list is, it is to be hoped that future editions will include a yet larger one.

It is not only in extent that the new edition marks an advance over the old, but also in the basis for the rating of machinery, which has undergone complete and radical revision. In the old rules a machine rating was established, from a thermal standpoint, by a standard rise in temperature under specified conditions of load, while, above the continuous rated load, certain provisions were made for an overload of considerable magnitude and duration. In the new edition this is all changed and greatly improved. Not rise of temperature but the actual temperature at the hottest spot in the insulation is made the fundamental consideration in thermally determining the rated load. Under no conditions is the permissible temperature of the hottest spot to exceed an assigned limit, depending on the nature of the insulating material. No thermal overloads are recognized or allowed. Temporary mechanical and commutation stresses in excess of rated load conditions are indeed called for, but if the insulating material is to be heated above the limit of permanent safety, the owner is supposed to apply such overloads entirely at his own risk and responsibility, after the machine has been delivered to him.

The old notion that a machine had a certain continuous-load rating, which was just safe to maintain and which yet might somehow be exceeded for a couple of hours every day was pernicious, both from scientific and commercial standpoints. On the other hand, the new basis of rating permits the user to apply extra loads to his machines intelligently and safely, in cases where the machines are worked at a low room temperature, say in winter time, with abundant ventilation.

American and Foreign Wiring Rules

We publish in this issue an extended and thorough comparison, arranged by Mr. Hugo Eisenmenger, of the interior wiring rules in force in the United States, Germany and England, with reference as well to practice in other foreign countries. A comparison between these rules is exceedingly instructive. In considering the matter one must bear in mind the fact that the rules of the several nations have a somewhat different origin. Those in the United States are practically dictated by the underwriters to an extent which is not at all true of either Germany or England, although properly enough the underwriters are influential in all countries. The general result is that the American rules "play safe" at every point so far as risks to property are concerned, somewhat irrespective of the real magnitude of the risk or the burden imposed by the regulations upon those who are doing the wiring. The foreign regulations are more concerned with obtaining practically good results under the circumstances of the installation than with obtaining ideal security at any price. Part of this difference is attributable to motives entirely of self-interest and part to the difference of actual structural conditions. The American rules are, in fact if not in principle, formulated for the protection of structures of the most inflammable character possible, frame buildings, generally very lightly built and finished in inflammable materials.

The foreign rules have been formulated for buildings of what we would classify as slow-burning or fireproof construction. This difference of attitude must be read into any discussion of the details of the wiring rules. Moreover, the point of view of the designer of wiring appliances is greatly influenced by the differences in construction to which we have referred. For example, in this country wooden moldings or metal moldings are recognized as legitimate and are freely used. In England wooden molding is permitted under moderate restrictions and metal molding is used hardly at all. In Germany wooden molding is not allowed and metal molding is unused, the customary German construction for the corresponding class of work being knobs on the exterior of the walls. Likewise knob-and-tube work, which is frowned upon here, although with proper care it can be made safe, is used neither in England nor in Germany because frame houses are rare and the construction employed does not lend itself to this particular form of wiring. The general difference in point of view which lies behind the rules is, in this country, that everything is to be suspected as liable to cause fire until it is proved to be safe. In Germany, England and other foreign countries the constructional features of the buildings are such that there is a reasonable assumption of safety if suitable care is used. There is no doubt that under similar conditions regarding the construction of buildings the American and foreign rules should come somewhat nearer together, yet some of the differences seem not to rest on reasons of this kind but rather on a more critical attitude of mind, influenced probably by the ultimate origin of the rule.

To take up somewhat in detail the variations shown in the paper before us, the most conspicuous one is the difference in the regulations concerning permissible sizes of wire. Under our own national code nothing smaller than No. 14 B. & S. gage is permitted except in fixture work and in pendent cord, which must never be smaller than No. 18. Germany and England both permit wire approximating No. 17 B. & S. gage as the minimum for interior wiring, and in fixtures Germany permits an area half way between No. 18 and No. 19 and England allows wires of sections slightly smaller than No. 21. The latter country, however, protects all its ruling by a specification of minimum permissible drop not to exceed 2 per cent plus a constant allowance of 1 volt. These differences are somewhat important as regards the cost of wiring, particularly so since the general introduction of tungsten lamps. There seems no good reason whatever for using wire as large as No. 14 for a branch leading to two or three 25-watt lamps, provided that the wires are properly fused. In house wiring particularly the American requirement seems somewhat burdensome at the present time. As to general methods of insulation in construction and of making connections, the regulations of the three countries concerned are very similar except that the American requirements are more specifically severe.

As will be seen from the tables, the insulation resistance requirements in America are many times as severe as in foreign countries, with the single exception of England, which, perhaps because of its somewhat damp climate, has requirements somewhat like our own. Many minor points of difference besides those here mentioned are observable, but the tendency in general throughout the respective regulations is such as to increase considerably the cost of installations in our own country as compared with foreign costs. How far this increase is intrinsically justifiable from the standpoint of safety, and how far it is directly related to the differences in building construction, is a matter which ought to have careful attention. Certainly, a distinction should be made here between buildings of slow-burning or fireproof construction and those in which the risk of inflaming the surroundings of a wire are notably increased. If buildings involving unusual fire risks were handicapped not only in the matter of wiring but in other particulars sufficiently to discourage their general construction, the results would be excellent.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

December A. I. E. E. Meeting

A meeting of the American Institute of Electrical Engineers will be held in the Engineering Societies Building, New York, on Dec. 11, at 8:15 p. m. Two papers will be presented, as follows: "Insulator Depreciation and Effect on Operation," by Mr. A. O. Austin, and "Effect of Altitude on the Spark-Over Voltages of Bushings, Leads and Insulators," by Mr. F. W. Peek, Jr. At the close of the technical session a smoker will be held and light refreshments will be served.

New Street Lamps for Washington, D. C.

Washington's business district will be brilliantly lighted for the Christmas shopping this year. Work has been begun on the installation of 130 1500-cp arc lamps in the section between Pennsylvania Avenue, G Street, Seventh Street and Fifteenth Street Northwest. The lamps, which will replace the present 700-cp inclosed-arc lamps, will be similar to those recently installed on Pennsylvania Avenue. The additional cost of maintaining the illumination of this area will be about $6,400 a year. Plans are being made to replace other arc lamps by high-efficiency tungsten lamps placed at frequent intervals along the streets.

Employers' Liability Insurance in California

The manager of the compensation fund of the Industrial Accident Commission of California has issued a report. With the report appears a statement that, barring any unexpected calamity, those who hold State compensation insurance policies will be allowed a return premium of from 5 to 25 per cent of the premiums earned, the amount depending upon the experience in the various hazard groups. This return, however, will not affect the minimum premiums. The California insurance laws require that claim reserves equaling 72 per cent of all earned premiums, less losses and loss expenses paid, be set aside, and this reserve must be maintained for five years. It is thought that there is no possibility that losses and loss expenses will equal that percentage, and that the difference between the reserve and the actual value of claims can ultimately be done away with. This would indicate a further return premium to 1914 policy holders, after a fair catastrophe surplus is set aside.

The initial insurance rates to be adopted for the coming year are the same as those charged by the standard corporate companies, with the exception of the excess premium returns mentioned. All plants are inspected and the merit classification is applied to many. Where allowed, special merit inspections result in rate reductions of 1 to 40 per cent, the average reduction being 10.08 per cent.

The financial statement just issued covers the period from Jan. 1 to Oct. 1, 1914, during which 5360 applications for insurance were received and 2478 accident cases handled. The expenses amount to 8.49 per cent of the premiums. The totals are as follows: Appropriation (1913 statute), $100,000; premiums received, less premiums returned, $462,514; interest received, due and accrued, $4,503; total, $567,017; expenses and salaries, $41,329; compensation and statutory medical payments, $52,528; outstanding cost, foregoing item, $110,456; unearned premiums, $138,684; surplus, $224,020.

Company Offer Rejected in Springfield, Ill.

The city authorities of Springfield, Ill., have decided to reject the offer of the Springfield Utilities Company to take over the municipal lighting plant and light the city streets for $30,000 less a year than the present cost to the city. The plan of city officials is to install a 750-kva turbo-generator purchased recently and light the streets and also furnish energy to some private consumers. The city intends eventually to abandon its present plant.

American Wood Preservers' Association

The eleventh annual convention of the American Wood Preservers' Association will be held at the Congress Hotel, Chicago, Jan. 19 to 21. Among the papers of interest to electrical engineers will be those on "Temperature Changes in Wood Under Treatment," by Mr. George M. Hunt, of the Forest Products Laboratory, Madison, Wis.; "The Properties of Creosote Oil," by Dr. Herman von Schrenk; "The Economical Use of Steam in Connection with Wood-Preserving Plants," etc., together with a number of committee reports. Mr. F. J. Angier, Mount Royal Station, Baltimore & Ohio Railroad, Baltimore, Md., is secretary-treasurer of the American Wood Preservers' Association.

Hearing on Water-Power Bill

The public lands committee of the Senate has set Dec. 9 as a day upon which hearings will begin on the so-called Adamson water-power bill, which was passed by the House at the last session of Congress and was referred to the Senate committee.

This bill, it is said in Washington, will meet strong opposition from senators who represent public-land states in the West. Senator Shafroth of Colorado is one of the strongest opponents of a proposed system for the leasing of public lands. He contends that lands containing water-powers as well as others should be opened to entry and ownership by residents of the states. Senator Borah of Idaho will also oppose the bill. A leasing system, he says, would only create another army of government employees and add to bureaucratic government.

The determination of the committee indicates, it is said in Washington, a desire to get the bill before the Senate as soon as possible. Whether the Senate will act upon the bill at the coming session will be determined largely by the wishes of President Wilson. Great stress has been laid by the President upon the need of

enacting this measure, as well as the general coal, oil and phosphate lands leasing bill, a hearing on which has been scheduled by the committee for Dec. 16.

American Physical Society at Chicago

A lecture entitled "X-Ray Spectra and the Nature of Alpha Rays," by Prof. W. H. Bragg of Leeds University, England, was the feature of the meeting of the American Physical Society held at Chicago University Nov. 27 and 28. The speaker's explanations of the atomic structure of crystals used in diffracting rays of short wave-lengths was made exceedingly clear by the use of carefully constructed models. One half-day session was devoted to discussions on spectroscopic evidence regarding atomic structure. Of the twenty-eight other papers presented, those dealing with experiments on selenium crystals, spark discharges between unlike metals, direct-current corona and the elementary charge of electricity were of particular interest as bearing upon the science of electrical engineering.

Developments in Cleveland

Chairman P. V. Kalina, of the committee on lighting of the City Council of Cleveland, Ohio, stated recently that he will introduce an ordinance authorizing a special election to vote upon a bond issue for the purchase of the property of the Cleveland Electric Illuminating Company if the company does not reduce its residence rate to 3 cents per kw-hr. The valuation of the property of the company which is under way by the Public Utilities Commission of Ohio will not be completed before next spring. The rates of the company are under consideration by the commission in connection with the valuation. Mr. F. W. Ballard, superintendent of the city lighting department, said he would not like to see a duplication of heating mains in the business district of the city and for that reason had not advocated a heating department for the municipal plant.

The Cleveland Electric Illuminating Company has secured the contract for furnishing energy to the National Power Company. The municipal plant also bid for the business.

A proposal to issue $500,000 bonds is pending before the City Council to secure funds for converting the Collinwood municipal plant into a substation, erecting a new substation at Woodland Avenue and East Seventy-ninth Street and extending the distributing system of the main plant. An additional issue of $200,000 is proposed for an ornamental light system in the business district. The Cleveland newspapers have been commenting on the amount of interest payable on the bonds for the new municipal plant. In addition, the state law provides that a sinking fund must be established to retire the bonds.

Rate Changes in Salt Lake City

Officials of the Utah Light & Traction Company have offered reductions in rates for lighting and motor service in consideration of permission from the City Commission to consolidate the franchise privileges of the Merchants' Light & Power Company and the Utah Light & Railway Company, both of which are controlled by the Utah Light & Traction Company.

The company offers to reduce retail lighting rates from 10 cents to 9 cents for the first 250 kw-hr. and from 9 cents to 8 cents for the second 250 kw-hr.; flat-rate arc lamps from $5.55, $6.67 and $11.11 per month for 10 p. m., midnight and all-night service respectively to $4, $5 and $8 per month respectively; the base rate on direct current from 11 cents to 9 cents for the first 100 kw-hr. used per month and the base rate on alternating current from 10 cents per kw-hr. to 8 cents per kw-hr. for the first 100 kw-hr. The commission and the company officials have agreed on the major portion of the proposed changes.

Co-operation in Export Trade

Additional trust legislation may receive attention at the coming session of Congress. Information obtained at the Washington headquarters of the Chamber of Commerce of the United States is to the effect that the trust committee of that organization intends to recommend the passage of an amendment to the Sherman law allowing a greater degree of co-operation in the conduct, and for the protection, of the export trade of the United States than is now possible. The suggested legislation has the support of a large majority of the boards of trade, chambers of commerce and other commercial and financial organizations affiliated in the national Chamber of Commerce.

Following the suggestion of the Chamber of Commerce of the United States, the Newlands act creating the Federal Trade Commission contains a clause instructing the commission to look into combinations in trade abroad with which American exporters are obliged to cope. The commission is instructed to make such recommendations to Congress for a suitable amendment to the Sherman act as will permit American manufacturers in export trade to form combinations and use common agencies to an extent that will put them on a business level with foreign competitors.

The members of the trust committee are as follows: Messrs. R. G. Rhett, Charleston, S. C.; Charles F. Mathewson, New York; W. L. Saunders, Ingersoll-Rand Company, New York; Henry R. Seager, Columbia University; Guy E. Tripp, chairman Westinghouse Electric & Manufacturing Company, and Charles R. Van Hise, president University of Wisconsin. At the Chamber of Commerce of the United States headquarters in Washington it was stated that the committee may urge President Wilson to appoint the members of the Federal Trade Commission as soon as possible.

Plan for Publication of Commission Decisions

As mentioned previously in these columns, the public-policy committee of the National Electric Light Association has adopted a resolution indorsing the plan for publication of the decisions and rulings of the public service commissions of the country in available form. The complete details of the arrangement have been announced this week.

The Lawyers' Co-operative Publishing Company, of Rochester, N. Y., will have charge of the editing and publication of the decisions, under the title of "Public Utilities Reports Annotated."

The reports will be issued in a series of selected annotated reports similar to the "Lawyers' Reports Annotated," which are published by the same company. The plan is to issue advance sheets in bi-weekly parts. When there is sufficient material in the advance sheets to justify the issue of a bound volume one will be published. It is expected that in the course of a year six bound volumes will be issued. The bound volumes will contain not less than 1200 pages. Each volume will contain tables of cases arranged by cases and also by

states. The cost is to be $5 per volume, including the advance sheet service.

The work will start with the decisions of commissions rendered, beginning with Jan. 1, 1915, and the first advance sheets will be issued shortly after that date. It is planned to publish all of the important decisions of the commissions in full. Rulings and orders dealing with standards, practices, etc., which are of general interest will also be published in full. The decisions which will be published are those relating to public utilities of all kinds with the exception of steam railroads. It is not planned to publish steam railroad decisions unless they have some incidental bearing on the general public utility situation. Publication will also be made of the decisions of state courts of last resort on public utility commission issues.

The decisions will be so annotated that they may be compared and the harmony or lack of harmony with other decisions in different jurisdictions made clear. The headings, annotations and digest will be so arranged as to provide convenient means of reference, not only for lawyers, but also for engineers and others who are unfamiliar with legal practices.

MEETING OF MECHANICAL ENGINEERS

Abstracts of American Society Papers on Cleveland Municipal Plant and Other Subjects

Among the papers presented before the American Society of Mechanical Engineers, which held its annual meeting in the Engineering Societies Building, New York, during the present week, were those of which brief abstracts follow:

Cleveland Municipal Plant

Mr. Frederick W. Ballard, commissioner and chief engineer of the division of light and heat of the city of Cleveland, read a paper on "The Design and Operation of the Cleveland Municipal Electric-Light Plant." He estimates that it would be conservative to allow for an average interest rate of 4.5 per cent on the investment value of $3,000,000. The tax rate can be estimated conservatively at 1.5 per cent. The amortization fund should be taken care of by a rate of 3 per cent as a conservative allowance because 2.92 per cent of the original cost invested annually at 4 per cent compound interest will equal the original investment in twenty-two years. Depreciation, obsolescence, etc., will be taken care of from the maintenance fund. These rates for interest, taxes and depreciation call for an annual allowance to cover fixed charges of 9 per cent on the original investment. Assuming a 40 per cent load-factor and a peak load of 18,000 kw would give a total output a year of approximately 60,000,000 kw-hr. Fixed charges for the entire plant investment of $3,000,000 at 9 per cent would amount to $270,000 per year, and on the basis of a 60,000,000-kw-hr. output, the cost per kilowatt-hour to cover fixed charges would be $0.0045, or $0.0015 for the station cost and $0.003 for the distribution cost. The estimate on unit costs for the new Cleveland plant is as follows:

Station costs: Coal, $0.002; labor, maintenance and sundries, $0.0015; fixed charges, $0.0015; total station costs, $0.005.

Distribution costs: Operation and maintenance, $0.004; fixed charges, $0.003; total distribution costs, $0.007.

Administration charges would be $0.0005, making a total cost of $0.0125. The profit required is stated at $0.004, making the average sale price required per kilowatt-hour generated $0.0165 on the 60,000,000 (estimated) kw-hr. to be generated.

Operation and maintenance costs for the new plant in August were stated as $4,543 and 809,120 kw-hr. were generated, making a unit cost of $0.0056. In September the operation and maintenance expense was $4,446 and 914,850 kw-hr. were generated, making a cost per unit of $0.0048. Indications are that a better load-factor than 40 per cent will be obtained. Energy for motor service is sold at rates ranging from 3 cents to 1 cent per kw-hr.

Damages for Loss of Water-Power

Mr. F. W. Dean, of Boston, Mass., in a paper on "Damages for Loss of Water-Power," stated that it is now generally understood that in the determination of the value of water-power consideration must be taken of the cost of making power by steam, which may be spoken of as the standard for comparison. This value is the capitalization of the annual saving by the use of water-power. The theory in a water-power damage case is that the award shall be such that the interest thereof shall be sufficient to equal fully the extra expense caused by the diversion. This rate is usually taken at 5 per cent, but is a subject for argument. It is obvious that the rate has a great influence on the award. In the case of an undeveloped power a higher rate of capitalization, say, 12 per cent or more, may be used as a means of scaling down the value, when estimated in some detail, and as representing the necessary profit of an enterprise.

Difficulties of Cities in Getting Advisers

Mr. Morris Llewellyn Cooke, director of the department of public works of Philadelphia, presented a paper on "Some Factors in Municipal Engineering." He said that with the growing consolidation of manufacturing and other enterprises, especially in the utility field, there is danger that the cities of the country will be left without proper engineering advice in certain of their engineering questions. He said that he had had unusual opportunities for seeing at close range the professional attitude of those equipped with the technical knowledge required in advisers to cities on utility matters. It has been practically impossible to secure the services of those with reputations already made in the electrical field. He called attention to the danger almost necessarily confronting the engineering of an industry dominated by financiers having no knowledge and little appreciation of such professional standards as engineers are supposed to have.

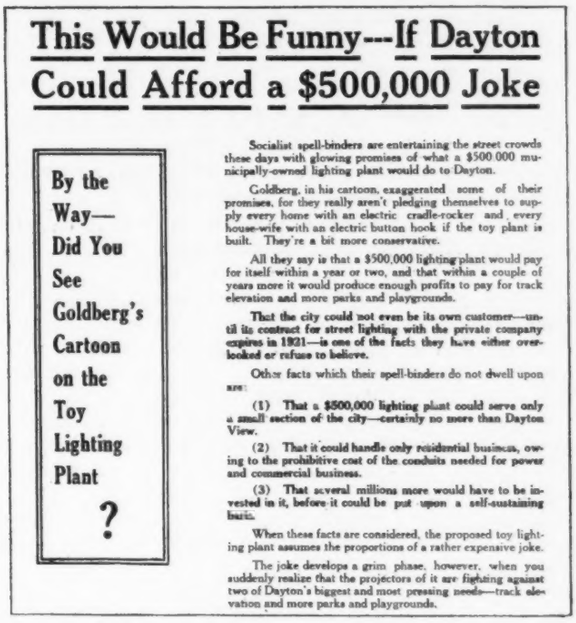
DAYTON MUNICIPAL PROJECT

How the Greater Dayton Association Defeated the Proposition to Erect a Municipal Lighting Plant

The work of a civic organization had much to do with the growth of sentiment that led voters of the city of Dayton, Ohio, to decide not to issue $500,000 bonds for a municipal lighting plant. Although the movement for a municipal plant was started by the socialists, the city commission which is in charge of the government of Dayton passed resolutions opposing the ordinance. The Greater Dayton Association, composed of 6000 members representing all classes of citizens, which was formed about the same time that the city adopted the city commission form of government through a city manager, took a firm stand against the proposed municipal plant. Besides the proposed issue for a municipal plant, two other bond issues were before the people at the Novem-

ber election—one of $1,000,000 to pay the city share in the elimination of dangerous railroad grade crossings and one of $250,000 for additional parks and playgrounds.

Mr. C. W. Lee, of New York, was engaged, and charge of the campaign was given to him by the association directors. In the three weeks that remained before elec-



This Would Be Funny---If Dayton Could Afford a $500,000 Joke

By the Way— Did You See Goldberg's Cartoon on the Toy Lighting Plant ?

Socialist spell-binders are entertaining the street crowds these days with glowing promises of what a $500,000 municipally-owned lighting plant would do to Dayton.

Goldberg, in his cartoon, exaggerated some of their promises, for they really aren't pledging themselves to supply every home with an electric cradle-rocker and every house-wife with an electric button hook if the toy plant is built. They're a bit more conservative.

All they say is that a $500,000 lighting plant would pay for itself within a year or two, and that within a couple of years more it would produce enough profits to pay for track elevation and more parks and playgrounds.

That the city could not even be its own customer—until its contract for street lighting with the private company expires in 1921—is one of the facts they have either overlooked or refuse to believe.

Other facts which their spell-binders do not dwell upon are:

(1) That a $500,000 lighting plant could serve only a small section of the city—certainly no more than Dayton View.

(2) That it could handle only residential business, owing to the prohibitive cost of the conduits needed for power and commercial business.

(3) That several millions more would have to be invested in it, before it could be put upon a self-sustaining basis.

When these facts are considered, the proposed toy lighting plant assumes the proportions of a rather expensive joke.

The joke develops a grim phase, however, when you suddenly realize that the projectors of it are fighting against two of Dayton's biggest and most pressing needs—track elevation and more parks and playgrounds.

ADVERTISEMENT OPPOSING BOND ISSUE

tion every available advertising and publicity medium was used. These included all the local newspapers, electric railway cars, billboards, electric flash signs, moving pictures, an outdoor stereopticon show mounted on motor trucks, house-to-house distribution of literature and the organization of a speakers' bureau. A window display was used, and night and noonday meetings were addressed by business men and also by various officials of Dayton's business administration.

Care was exercised to show the people that it was not the principle of municipal ownership that was being fought, but the impracticability and financial inexpediency of a five-hundred-thousand-dollar plant when Dayton had so many real and pressing needs. The returns showed that the project, which needed only a majority vote for passage, was defeated by more than 4000 votes.

GENERAL BUSINESS CONDITIONS

Civic Federation Report, Based on Replies to Inquiries, Indicates Period of Depression Is Over

Mr. John Hays Hammond, chairman of the industrial economics department of the National Civic Federation, presented a report at the annual meeting held at the Hotel Astor, New York, on Dec. 4 and 5 on business conditions throughout the country. It was compiled from the reports of about 600 business men, public officials, economists and sociologists. The substance of his findings is that the worst of the business depression is over, and that while the cumulative effect may be felt for a few months to come, particularly in the way of non-employment and resultant destitution, the state of the nation in general is a promising one. Two series of reports were received, one dated about Oct. 20 and one in November. The changes reported between the two dates are in the majority of cases toward betterment. Many correspondents who were unable to report actual improvement insisted upon the prevailing note of confidence which is in marked contrast to the hesitancy and uncertainty of a month ago.

ELECTRICAL EXPORT DEVELOPMENT

Possibilities and Problems Incident Thereto Discussed Before Electrical Manufacturers' Club

Mr. William S. Kies, of the National City Bank of New York, read a paper on "Possibilities and Problems of Our Export Trade" before the annual meeting of the Electrical Manufacturers' Club, held at Hot Springs, Va., on Nov. 4 to 7.

Constant popular agitation against business interests, ill-considered restrictive legislation and unscientifically made tariff laws, operating in connection with fundamental economic causes, have caused a serious decline in business during the last few years, said Mr. Kies. With a consequent smaller demand resulting in the contraction of domestic markets, the American manufacturer, in order to keep his plant going and labor employed, has been compelled to seek other permanent markets for his surplus product, and in this effort has been obliged to meet the keen, skilful competition of the most experienced trader in the world, the English merchant, and the most scientific and calculating business man in the world, the German merchant.

To many the European war yet means a horrible nightmare. It is right, however, that we should study the European situation in its effect upon our commercial future. The conclusion is reasonable that the difference in the cost of production of many competitive articles here and abroad in numerous cases will be wiped out, at least during the few years immediately following the war and before the stricken nations recuperate. Now, then, is the time to take advantage of the opportunities which are to be ours, not in a spirit of exultation over the misfortunes of others, but rather in the light of an obligation imposed on us.

Mr. Kies suggested that co-operation in a movement which means so much to the welfare of this country becomes a patriotic duty. Let the electrical industry, for example, retain an expert to study carefully the needs of every foreign market open to this country, to obtain data as to the cost of production here as compared with the cost of production abroad, to ascertain the quality and character of the article needed for a particular market, to obtain figures as to the decrease in net cost if the various plants in the industry are run to capacity, and to obtain for all members of the industry scientifically complete and reliable information concerning all phases of the export problem. Experts representing various industries working in conjunction can accomplish much toward simplifying the mechanical detail of export trade. Then, too, there should be co-operation in sales campaigns designed to introduce to the consumer the American manufactured product.

It was also suggested by Mr. Kies that American manufacturers join in an effort to obtain legislation supplemental to the Clayton and Federal Trade Commission bills, providing that the prohibitions of the Sherman act in reference to competition do not apply in the foreign trade of the United States. If it is not possible to obtain the passage of a provision so general in its nature, it might be provided that such agreements should be legal if approved by the new Trade Commission and that the test of their legality be the question of whether the results to be obtained are beneficial to the trade or industry as a whole and not inimical to the interests of consumers in this country.

VALUATION OF CINCINNATI UTILITY

President W. W. Freeman Claims Company Should Have a Portion of the Benefits of Economies Effected

In discussing the valuation of the property of the Union Gas & Electric Company and the recommendation of a reduction in rates made by Mr. A. C. King for the City Council of Cincinnati, President W. W. Freeman, of the company, said:

"The city solicitor is quoted as saying that where doubt existed in Mr. King's mind, such doubt 'was resolved in favor of the city.' This clearly brands the report as a partisan document and robs it of any judicial standing whatever.

"Mr. King, after resolving all doubts in favor of the city, finds a surplus earning of $330,000, which sum he recommends be utilized in rate reductions. He proposes that the earnings of the company shall be reduced to correspond strictly and absolutely with the amount of its expenses, which he admits are unusually low, and a return of 8 per cent per annum on his valuation of the electric property. In arriving at this valuation he has ignored actual investment, which is greatly in excess of his valuation. The valuation allowed by him is also very much below his own estimate of what it would cost to reproduce the electric property now, which figure he gives at approximately $8,000,000, but he then deducts from such result about $1,200,000 as accrued depreciation, thereby arriving at the net value upon which the company is entitled, in his opinion, to earn a fair rate of return.

"The deduction of his estimated depreciation is probably one of the 'doubts' decided in favor of the city. This doubt, however, involves the denial of an admitted actual expenditure of $1,200,000, and its earning power represents a large proportion of the surplus earnings which it is proposed to 'utilize in rate reductions.'

"Mr. King admits in his report that the operating expenses of our company have been exceedingly low in comparison with other similar companies. Had the company been extravagant in its expenses it would have been rewarded on the basis of rate-making proposed by Mr. King by being allowed to earn correspondingly higher rates. We claim, and we think the public will agree, that unusual economy or efficiency of operation should be recognized as entitling the company to at least a portion of the benefits of such economies. Otherwise it would be to our interest to spend all the money possible in order to make the rates correspondingly high, in which case neither the public nor the company would receive any benefit."

Advertisements of the company, containing similar statements, have been published in the Cincinnati daily newspapers.

A new rate ordinance for the Union Gas & Electric Company has been submitted to the City Council of Cincinnati by City Solicitor Schoenle. It is for a period of ten years and makes a maximum rate of 8 cents per kw-hr. It eliminates any minimum maintenance charge and provides that each new consumer shall be furnished with 150 ft. of wire and pole-line equipment therefor without charge. A fine of $50 is stipulated for each violation of the ordinance.

The first public hearing on the ordinance was held before the light committee of the City Council on Nov. 27. Mr. Freeman declared that the Council has power to propose a light rate but not to enforce it. Mr. Herbert S. Bigelow agreed with Mr. Freeman on this point, but insisted that there should be a minimum as well as a maximum rate. As president of the People's Power League he threatened to appeal any ordinance that fixed a maximum rate greater than 7 cents.

Mr. Freeman declared that the company will not accept the present ordinance, but will appeal to the Public Utilities Commission if it is passed.

Mr. Samuel Assur spoke for the stockholders' protective association. He advised proper consideration of the interests of the 8000 stockholders and was opposed to waiting for the report of the Public Utilities Commission. The Schoenle ordinance was opposed by Mr. Assur, who said that the present rates should be continued, or, at least, no reduction should be made.

MR. DOHERTY ON BUSINESS CONDITIONS

On His Return from Europe He Finds an Astounding Change in Sentiment

Mr. Henry L. Doherty returned to New York on Nov. 17 on the steamship *Transylvania* from a trip to England. He sailed from New York for the other side on Oct. 14 and spent a little over three weeks in England, being in London most of the time. In speaking to a representative of the *Electrical World* about business conditions as he found them in England and in this country on his return, Mr. Doherty said:

"I went to England in order to have a conference with our European representatives. I did not expect to take up any particular new business, but I had the conferences that were the object of the trip. I was rather surprised to find how confident everybody seemed to be about the ability of Great Britain to handle the financial conditions arising from the war, including the raising of funds for the campaign, without any disturbance. England is not underestimating the amount of money, time or men that will be required, but no feature in the outlook appears to cause the least alarm.

"The shopping district in London is about as busy as ever. Except for the presence of soldiers everywhere, and especially in great numbers along the east coast, there is little evidence of war. Men are being drilled even in churchyards and in all parks. Except along certain lines like the manufacture of jewelry and cotton goods, there is not much evidence of a falling off in industrial activity. There is a good deal of evidence of increased business activity in certain lines due to the orders for war supplies of all kinds. Orders of this character mean that some factories are being crowded to the fullest extent that they will stand. Almost everybody in England is doing something for the purpose of relieving distress and suffering of the people at home and at the front.

"The street lighting in London is reduced to such an extent that it makes one nervous to ride at night in a taxicab. This, of course, is done primarily to avoid interference on the part of the street lighting with the work of search-lanterns. Apparently observation towers are scattered pretty well over London and the east coast. In some places these towers are improvised in one way or another, but in other places the tops of buildings are used.

"I do not believe that any one can determine the immediate outlook in the investment situation. There is not much doubt that the European buying power is cut down enormously by the war. On the other hand, the most significant factor I observed is that everybody is assured that, outside of subscriptions to the war loan, what investment buying there is will be in American securities. People who have criticised the American market and securities and 'Yankee' policies are not talking that way any longer. The universal feeling is that American securities are the safe securities to buy now. Certainly very much the largest percentage of investment buying for a time in the future will be in Ameri-

can securities. Even now a certain amount of investment buying is going on and inquiries keep coming all the time.

"Bankers in England feel that there will be enough new investment buying of American securities to offset the forced liquidation, and that in addition to that factor there will later be an absorption of a reasonable amount of securities from investors in this country.

"On my return I was astounded to see how greatly sentiment had changed during the time of my absence. People who told me before I left that in their judgment we should have a long period of business depression were the first to tell me when I got back that we are going to see greatly increased industrial activity here. The news from our operating properties is, on the whole, very encouraging. As a matter of fact, I think that I see a more pronounced change in sentiment than the actual conditions warrant. It is important to remember, on the other hand, that nothing contributes so much to increase the stability of business as a sentimental feeling that conditions will improve. How much the news of the election has contributed to the changed conditions that are evident everywhere I do not know. Certainly it has played an important part in the condition of sentiment. The result of the election is, I think, interpreted generally as a protest against too much interference with business. It has been interpreted by business men, and especially by the people, as an indication that the great body of voters want to have every encouragement given to our railroads and business industries. I think that the record of views expressed by the election will tend to lead the present administration to go still farther in its encouragement of business."

CONTRACTS FOR STREET LIGHTING

Cost of Service Provisions in Specification for Such Contracts Under Commission Regulation

The contracts for street lighting made recently in Watertown, Wis., by the Watertown Gas & Electric Company and in Clayton, Mo., and Richmond Heights, Mo., by the Electric Company of Missouri are unique in being the first contracts of their kind to follow the recommended standard forms on file with the National Electric Light Association and the Association of Edison Illuminating Companies, as drafted by the subcommittee on the form of street-lighting contracts and specifications of the joint street-lighting committee of these associations. The contracts for Clayton and Richmond Heights were ratified by referendum votes in those communities.

These contracts proceed upon the assumption that the price for service is subject at all times to regulation by a public service commission and that the terms relating to price of the initial installation of street lamps or of any substitute installation of better type or of additional lamps and the price for relocation of existing lamps, etc., must be based upon the cost of the service, including a reasonable return upon the investment made by the utility. Since the cost of service is at all times subject to determination by the commission, the municipality has the assurance that it will participate in future economies, and the greatest freedom is given to it in changing the type and kind of street-lighting service, should it so desire. The possibility of such changes during the period of the contract are anticipated in the specification. Changes from and additions to the initial installation are made at a price sufficient to care for the cost including depreciation, return upon the investment and the amortization of special investment, should changes or additions be required during the latter years of the contract. The provision is made that the additional cost due to such amortization may be refunded to the municipality should it, at the expiration of the contract, extend the term of use of such equipment for an additional period of years.

The provisions of the Watertown contract and specification are typical and may be summarized as follows:

(a) *Specification of Initial Installation.* The contract provides for a minimum of 100 arc lamps and the specification contains the technical and descriptive data as to type, wattage, candle-power of lamps, the type of suspension and bracket supports, the height of lamps and the location of the initial installation, the type of distribution system and the hours of lighting, and the rates for initial service.

(b) *Deductions for Outages.* Should lamps of the type specified fail to be illuminated during the hours of lighting for any reason, there is to be deducted from the compensation due the company a pro rata part of the average annual rate, determined in accordance with the number of full hours of the outage. The company must keep a daily record of the time energy is supplied to each of the circuits from which the lamps are fed and the time of cutting off the energy for the purpose of extinguishing the lamps. The company must also keep a daily record of all lamps reported to it by the city police or any other city department as being out of service. At the end of each month the company is obligated to furnish the city with a copy of its record of all lamps out, showing the hours and minutes during the lighting period of each day during which each lamp is out of service.

Twice the amount of this penalty is provided if the company fails for a full period of twenty-four hours to relight any lamp reported out of service, provided that there are no conditions beyond the control of the company which prevent the relighting of the lamp.

From the standpoint of the company these penalties are severe, since all that the utility saves during the period of outage is the energy not used by the lamps, whereas the rate includes, in addition to the cost of energy, fixed charges, which continue irrespective of whether the lamps are lighted or not.

(c) *Additional Lamps and Changes in Location.* The company agrees to install any additional lamps which may be required by the city and to move or remove any lamp as ordered by the city within twenty days after receipt of official written notice by the city. One additional working day is to be added to this twenty-day period for each additional lamp ordered at any time over one lamp. Should the company fail to erect and light or move and remove any lamp or lamps as ordered by the city within this stipulated period, it must pay the city, as liquidated damages and not as penalty, a sum equal to one three-hundred-and-sixty-fifth part of the annual rate for each lamp for each working day of failure to comply with the order of the city. The company is relieved from such obligation to comply during December, January, February and March and in case of strike, fire, action of the elements or other conditions beyond its control.

(d) *Easements.* Provision is made that where lamps are ordered installed by the city at locations which require the company to extend its services over private streets upon which it has no easement the city must obtain, without cost to the company, all rights and permits from abutting property owners affected when and as needed by the company.

(e) *Discontinuance of Lamps.* To the city is given the right to discontinue any or all lamps of the initial or subsequent installation at any time upon service of ten days' written notice to the company of its intention so to do. In case the city orders lamps discontinued,

it must reimburse the company for any unamortized special investment which the company has been required to make on account of furnishing lamps so discontinued. Nothing in this provision, however, is to be construed as giving the city the right to reduce the number of lamps below the initial number specified in the contract, nor to relieve the city from paying the company as a minimum the amount due it for the initial installation.

(f) *Rates for Additional Service.* The city has the right to order additional lamps installed under the terms and at the rates specified in the contract for the initial installation of lamps subject to the following conditions:

(1) Location. Should a single lamp be ordered at any location within 500 ft. of any existing lamp or circuit, the entire expense of the installation and necessary operating equipment is to be borne by the company, but should a single lamp be ordered at any location at a distance greater than 500 ft. from any then existing circuit of street lamps, the city must pay the company the added cost of installing such lamp over and above that which would be reasonably necessary to make the installation at a point 500 ft. distant from such then existing street-lighting circuit or lamp. Such added cost is to be gross added cost less the reasonable estimated recovery value of the material at the expiration of the contract. Should more than one lamp be ordered at any time within the city limits and so located and specified as to enable the use of such lamps, on the single circuit, the entire cost is to be borne by the company, provided that the average distance of the lamps apart measured by circuit is not greater than 500 ft., or the nearest lamp to the then existing lamp or circuit does not exceed 500 ft. Otherwise the city must compensate the company for added cost as specified above.

Should the city make payments to the company for lamps installed at a greater distance than 500 ft. apart, as above defined, and should the city later order lamps between such lamps so as to make the average distance between lamps not more than 500 ft., the company must then refund the city payments made for any such extensions.

(2) Rate of Charge. Subject to the condition (1) immediately preceding, the company must furnish additional lamps of any type covered by this contract which may from time to time be ordered by the city at the rates specified for the installation of the lamps, provided that such lamps are ordered before the beginning of the last three years of the contract period.

Lamps ordered installed by the city during the last three years of the contract period will be supplied by the company subject to the rates for the initial installation of lamps and other conditions of the specification, plus a sum which, when spread over the remaining life of the contract in equal monthly payments, will reimburse the company for the special investment necessary to install and light such lamps.

Prior to the expiration date of the contract the city will have the right to extend this contract for a period of not less than five years, in which event the company is to refund the city the additional charge paid by the city for lamps installed during the last three years of the contract.

"Special investment" is defined to include the difference between the cost new and the conservatively estimated recovery value of the lamp, its bracket or support, including special poles, the cost of extending lines or circuits as may be necessary to reach such lamp, together with the proper proportion of new special station equipment necessary to supply the character of energy required for the operation of the lamp.

(g) *Substitution of Different Types of Lamps.* The city has the right to require the company to substitute, subject to review by the Public Service Commission of the State, or the company has the right to substitute for the type of lamps specified, new and improved lamps of at least equivalent illuminating power. In case such substitution is contemplated and mutually agreed upon, the party to the contract desiring such substitution must serve upon the other party written notice setting forth in detail the character of lamps which it is desired to substitute in place of those covered by the specification. The Public Service Commission of the State is not only to approve the substitution desired but is to specify the rates of charge at which the company shall supply the new types of lamps, such rates for new lamps to be specified before the work of making any substitution shall be started.

(h) *Compensation for Relocation of Lamps.* The city may order changes from time to time in the location of lamps theretofore installed or order the character of service changed from overhead to underground. For such changes in location or in character of service the city must compensate the company for the full net cost of complying with such orders. "Net cost" is defined to include the difference between the expenditures made by the company and the estimated recovery value of the additional material used at the expiration of the contract.

(i) *Damages.* The company agrees that it will keep, indemnify and save the city harmless from any claims for damages arising out of the negligent stringing of wires on the city streets, the negligent erection of poles thereon, the negligent placing of other apparatus and appliances for street lighting, and the negligent maintenance and operation of such equipment for street-lighting service covered by the contract, and agrees further that it will hold the city harmless from any claims for damages arising out of the negligence of the company, its agents, servants or employees in furnishing street-lighting service.

(j) *Disputes.* Disputes arising out of the performance of the contract or compliance with its specifications which cannot be mutually adjusted by the city and company are to be promptly referred for decision to the Public Service Commission.

(k) *Payments.* The usual provisions are made for monthly payment for street-lighting service and the adjustment of disputes arising out of offsets and counterclaims arising out of the performance of the contract.

The statutory provisions in both Wisconsin and Missouri limit the term of street-lighting contracts to ten years. Under provisions such as outlined it is obvious that the period of contract most satisfactory to the municipality would be indeterminate rather than limited in time. In such cases the condition of termination would be the compensation to the utility of the present value of the special investment devoted to street-lighting purposes. Where the contract is indeterminate the possibility of high amortization costs is minimized and changes in type with the progress in the art are introduced at least expense. It is probable that under the present limited-term form municipalities will find it to their advantage to renew the contract at its expiration in order to secure the difference which extended use of additional equipment will provide. The usual uncertainty, however, as to the action of the city during the last years of street-lighting contracts has postponed needed additions and improvements in many cases. Such a condition will be lessened under the proposed form of limited-term contract. With an indeterminate contract and similar provisions, such conditions would be entirely eliminated.

PUBLIC SERVICE COMMISSION NEWS

California Commission

The Pacific Gas & Electric Company, of San Francisco, has been ordered by the commission to submit plans for equipping its generating plants and distribution circuits with various devices designed to minimize the danger to persons and property resulting from contact with high-tension lines. This order was issued as the immediate result of a hearing in which a complaint was made by Mr. W. S. Junkin, who sought to compel the company to install circuit-breakers of the overload-release type on all of its transmission lines within the State. The commission states that the greater number of cases of line failure resulting in hazard to life and property could not apparently be prevented by station protective devices but could in many instances be prevented by more careful construction and maintenance of lines. The commission has, therefore, decided to investigate the construction, maintenance and operation of all power, telephone, telegraph and signal lines.

The Pacific Gas & Electric Company has applied to the commission for leave to establish new tariffs for motor service in all territory in which the commission has power to make rates. The new schedule provides for a minimum charge of $1 per month per hp for the first 50 hp and 50 cents per month per hp for each horse-power over 50. The schedule now in effect provides for a minimum of $1 per hp per month for all installations. The company states that, although certain rates will be slightly increased by the operation of the new schedule, rates on the whole will be reduced and revenues decreased for the same service as is now rendered. The company also asks authority to make certain changes in rates for electric motor service for reclamation work.

Idaho Commission

The commission has issued an order fixing rates for the cities of Moscow, Genesee, Troy and St. Maries, now served by the Washington Water Power Company, and has cited the company to show cause why the rates should not be put in force. An investigation of the rates charged has been postponed because of a pending court suit regarding the right of certain complainants to free access to the company's books. This suit was decided recently by the Supreme Court, which held that not all the books, but only those which the commission decided were necessary to the prosecution, could be made accessible to the complaining company.

For the first 8 kw-hr. or less per month the rate is fixed at $1; for the next 12 kw-hr. or less, 11 cents per kw-hr.; for the following ten hours or less, 10 cents; for all over 30 kw-hr. to 72 kw-hr., 8 cents; for all over that amount, 5 cents per kw-hr.

Missouri Commission

Engineers and accountants have begun an investigation of the accounts and property of the Kansas City Electric Light Company in accordance with an agreement made between the Missouri Public Service Commission and the officials of Kansas City some months ago. At that time Mayor Jost appeared before the commission and agreed to certain readjustments of rates. The commission promised to send representatives to determine the value of the property and the earning capacity. Since then the company has prepared the information at its own expense and it has been published. The representatives of the commission are checking the data. When their work is finished a report will be made to the commission, which will hold a hearing in Kansas City. This meeting probably will not take place until next spring.

New Jersey Commission

The Board of Public Utility Commissioners has handed down a decision in a complaint brought by eleven proprietors of moving-picture establishments at Paterson against the rates for service charged by the Public Service Electric Company. The board holds that the rates now charged are unjust and unreasonable and orders the company to adopt the following schedule, effective on Dec. 17, for moving-picture arcs:

First step: 10 cents per kw-hr. up to and including an amount equal to 75 kw-hr. per horse-power of connected load in each month. Second step: 5 cents per kw-hr. in excess of the consumption noted in the first step in each month. A minimum charge of $1 per month per horse-power of connected load is to be established. In conclusion the board says:

"It appears to be clear that the service for moving picture establishments involves conditions which are not strictly similar to those imposed by either lighting or motor service. In the board's opinion, a special schedule is applicable and is warranted. To avoid discrimination, strictly speaking, unless there is some other influencing factor, service to moving-picture machines ought to be on as favorable a basis as for other purposes having similar factors. In formulating a rate schedule for this class of service, the board has aimed to adjust this automatically, and the result from the new schedule will result in a net charge ranging from 10 cents per kw-hr. to the present average revenue for all purposes."

New York Commissions

The Merchants' Association of New York has submitted to the Public Service Commission, First District, a petition for an order revising the entire schedule of rates and charges of the New York Edison Company, basing such revision upon a comprehensive investigation of the affairs, earnings and methods of the company and upon a valuation of its property. The commission at the present time has before it a proceeding for the reduction of rates for small consumers. The Merchants' Association's petition asks for a further reduction in the rates for large consumers, stating that the profits of the company are excessive and unreasonable and are mainly made from the sale of energy to large users, holding that very little profit is derived from small consumers. The immediate result of taking up the new investigation would be to delay a decision in the original proceedings, and the commission has not as yet ordered a hearing in the matter.

Ohio Commission

The commission is arranging to put its new accounting system into operation on Jan. 1, 1915. Mr. Carl S. Nau, of Nau, Rusk & Swearingen, of Cleveland, is working on a complete revision of the original draft. It is believed by members of the commission that the adoption of the uniform accounts will give a broader insight into the business than has been provided in the past.

There is some uncertainty in regard to the fate of the Public Utilities Commission under the administration of Governor-elect Willis. In some quarters it is believed that the commission will be reorganized under another name, with a Republican majority, as was done under the Cox administration.

Wisconsin Commission

To promote the sale of its bonds among small investors the Wisconsin Railway, Light & Power Company has been authorized to issue $10,000 of 5 per cent bonds in denominations of $100. The issue is to be secured by the pledge of a similar amount of bonds in denominations of $1,000.

Current News Notes

ELECTRIC HEATING APPLIANCES IN DOMESTIC-SCIENCE INSTRUCTION.—An appropriation of $150,000 has been voted by the Board of Education at Richmond, Cal., for equipping the domestic-science departments in the new school buildings with electric-heating appliances. The equipment to be installed includes twenty-six disk stoves, two electric ovens and an electric circulating-water heater.

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MINNESOTA PUBLIC UTILITY RATE.—Prof. Gerhard A. Gesell, of the department of economics in the University of Minnesota, has recently published a book on rates for gas, electricity and water in Minnesota. The book is a compilation of gas, electricity and water rates in 214 towns and cities in Minnesota having a population of 500 and over. No attempt has been made to draw any hard and fast conclusions or to make any special grouping. The work is a valuable one.

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TREE-TRIMMING DIFFICULTIES IN LOUISVILLE SETTLED.—The Board of Park Commissioners of Louisville, Ky., and the Louisville Gas & Electric Company have reached a satisfactory agreement as to the supervision of tree-trimming along the public streets, where the interests of the Park Board, which has supervision of the trees, and the lighting company frequently conflict. At a recent meeting of the Park Board it was announced that the gas and electric company had agreed to pay the salary of a superintendent of tree-trimming to have authority over the gangs of the gas and electric company and to be an officer of the Park Board.

* * *

BOISE COUNCIL SEEKS TO PROTECT LIGHTING COMPANIES.—The Boise City Council has by unanimous vote suggested to the Public Utilities Commission of the State of Idaho that no rules or regulations should be adopted by the commission in connection with line construction which will impose any unnecessary burden or expense upon the building, maintenance or extension of electric transmission or distributing systems. It was also the sense of the city fathers that no rules or regulations should be adopted to favor the telephone companies at the expense of the electric companies, or which will recognize anything but legal rights between the two classes of utilities.

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WATER-POWER SURVEYS IN SNAKE RIVER BASIN.—Topographic engineers of the United States Geological Survey have been making profile surveys in the Snake River basin, Idaho, and the results of their work have just been published by the Geological Survey in Water-Supply Paper 347, which contains also a map of the area examined. The Snake River basin contains many good storage sites but only a few have been utilized. About 400,000 acre-ft. of water can be stored in Jackson Lake by a dam which has been constructed by the Reclamation Service. The largest site is at Swan Valley, on Snake River, where the water available for storage is approximately 4,000,000 acre-ft. The streams afford enormous water-powers, but only a few sites have been developed owing to the lack of market.

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RADIO LAWS AND REGULATIONS OF THE UNITED STATES.—The Department of Commerce has collected and combined in one small volume (100 pages) the various laws, treaties and regulations relating to radio signaling in the United States. The pamphlet is divided into four sections, entitled respectively, "Radio Communication Laws and International Treaties," "Regulations Governing Ship and Land Radio Stations," "Regulations Governing Radio Operators," and "General Information." The London radiotelegraphic convention is given in full, as are the requirements for operators' and station licenses. The book concludes with an appendix containing the authorized license forms and showing the international Morse code and conventional signals. The entire subject matter is carefully indexed. Copies may be had from the superintendent of documents, Government Printing Office, Washington, for 15 cents each.

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SOCIETY MEETINGS

NEW YORK SECTION, I. E. S.—"The Art and Science in Home Lighting" is the title of a paper to be presented before the New York Section of the Illuminating Engineering Society on Dec. 10.

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CHICAGO SECTION, E. V. A.—At the weekly luncheon of the Chicago Section of the Electric Vehicle Association of America, held at the Railroad Club, Karpen Building, Chicago, Nov. 24, Mr. George B. Foster, assistant to the vice-president of the Commonwealth Edison Company and chairman of the association committee on rates, abstracted a recent convention paper on electric charging stations along the Lincoln Highway.

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JOINT MEETING OF CHICAGO ENGINEERING SOCIETIES.—In a paper entitled "Electric Lighting a Factor in Civilization," presented by Mr. S. E. Doane, Cleveland, Ohio, before the joint meeting, Nov. 24, of the Electrical Section of the Western Society of Engineers, and the Chicago sections of the American Institute of Electrical Engineers and the Illuminating Engineering Society, the author asserted that the broad electrical engineering problem of to-day lies in finding an inexpensive method of supplying electric service to every household. Mr. Doane also spoke at some length on the importance of serving the small customer, and in the technical portion of his paper he described research work which has been done in perfecting the gas-filled tungsten lamp. Messrs. E. M. Tompkins, P. Junkersfeld, W. A. Durgin, J. R. Cravath, E. W. Lloyd, Victor H. Tousley, M. G. Lloyd and A. Scheible, all of Chicago, and Prof. W. C. Bauer, of Evanston, spoke in discussion of the paper.

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ELECTRICITY AN IMPORTANT FACTOR IN MOTION-PICTURE PRODUCTION.—"Practically every mechanical operation in the production of moving-picture films, with the exception of water heating, is accomplished electrically," declared Mr. W. R. Rothacher, manager of the Industrial Moving Picture Company, Chicago, in speaking before the Chicago Jovian League on Nov. 30. For stage work in producing pictures under artificial light as many as 150 mercury-vapor lamps are sometimes used. On the other hand, excellent industrial pictures can be taken in factories with an equipment of a dozen 4000-cp arc lamps. Referring to the commercial applications of moving-picture films, Mr. Rothacher said that many American manufacturers of heavy machinery are successfully using this method to carry convincing demonstrations to customers in South American countries. The speaker asserted that there are now 2000 motion-picture theaters in Illinois and 12,000 such theaters in the United States, besides 18,000 other places in this country where motion pictures are shown. Mr. Rothacher also expressed his belief that the motion-picture industry is still in its infancy. Within a few years, he said, he expected to see many smaller projectors in use in clubs, halls and private homes.

Hydroelectric Development on Bishop Creek, Cal.—VIII

Further details concerning the transmission system of the Nevada-California Power Company—The substations at Goldfield, Tonopah, Miller's, Manhattan and Rhyolite. By C. O. Poole

THE branch line to Goldfield ends at the substation in an outdoor bus parallel with the building. Two taps lead into the building directly to two banks of transformers through Kelman automatic oil switches. One bank of transformers consists of three 300-kw Stanley self-cooled units, and the other bank consists of three 750-kw General Electric self-cooled units. All are provided with water-cooling coils for use in hot weather. Preparations are now being made to put weatherproof covers on the transformers and move them outdoors. The transformers reduce the voltage from 55,000 volts to 6600 volts, the banks being connected to a common bus. There is a receiving panel for each bank. The switchboard also has four three-phase, 6600-volt motor-feeder panels, one single-phase lighting panel and one series arc panel, the arc circuit being controlled by a General Electric regulator. The lighting circuit is controlled by a General Electric type regulator. Each of the local circuits is provided with Westinghouse multiple-gap lightning arresters. The high-tension line is provided with a 55,000-volt General Electric electrolytic arrester in a separate concrete building, situated 100 ft. from the main building. Fig. 62 is a general view of the station. It might be noted here that all the distributing lines of the company in Nevada are operated at 6600 volts. This system has been found quite satisfactory and has proved economical in reaching the scattered customers. The Goldfield substation was one of the first stations built and the first to receive energy from the power plants. The building is a substantial stone structure with steel roof. Comfortable living quarters for the attendant are built as part of the structure. There being but one attendant at this station, an alarm is arranged to call him at night if anything goes wrong with the system.

Tonopah Substation

The line from the Alkali switch station and the copper line from Miller's substation join at the Tonopah substation, the Alkali line connecting to the outdoor bus through a 55,000-volt Kelman automatic outdoor-type oil switch and the copper line from Miller's connecting to the same bus through a Baum open-air switch. A Bowie outdoor-type lightning arrester is connected to this same bus. There are two banks of transformers placed outdoors, one bank consisting of three 300-kw Stanley units and one bank of three 500-kw Westinghouse units. There are also three 500-kw Stanley transformers inside the building. The high-tension lines lead from the common bus through Bowie automatic outdoor switches. All the transformers are wound for 50,000 volts, connected star with solid grounded neutral. The low-tension side is wound for 7200 volts with taps for 6600 volts, delta-connected. The transformers are of the self-cooled type, with water coils for use in hot weather. Water is circulated through the coils by means of a small centrifugal motor-driven pump and cooled by means of a tank tower, so that very little renewal water is required. Fig. 63 is a general view of the station. The 6600-volt switchboard within the station consists of three receiving panels, four three-phase feeder panels and a series street-lighting panel. A three-phase hand-operated regulator is provided for changing the bus voltage when required. Until recently all the transformers were installed inside the building. A serious fire in the station prompted the placing of the transformers outdoors. The only change in the transformers required was the waterproof covers and porcelain bushings. It is interesting to note that the transformers run from 5 deg. to 10 deg. cooler outdoors than inside, even in very hot weather. This station is also provided with good living quarters for the station attendant. Nearly the whole output of this station, as well as that of the other stations in Nevada, is used for mining purposes. There are several mine hoists operating on the system using 300-hp variable-speed induction motors.

Miller's Substation

Situated 12 miles north of Tonopah is a large ore-reducing mill at the town of Miller's. Ore from the Tonopah mines is hauled here by rail for treatment. Fig. 64 is a general view of the 1500-kw substation. This station is 30 miles from Silver Peak and is fed by the No. 0 copper line leading from that point. A tie line of the same size connects the Miller's station with the Alkali line at Tonopah, thus closing the loop of the two lines from Silver Peak. Fig. 66 shows this connection. The line from Silver Peak enters the station and connects to the high-tension bus through a Kelman oil

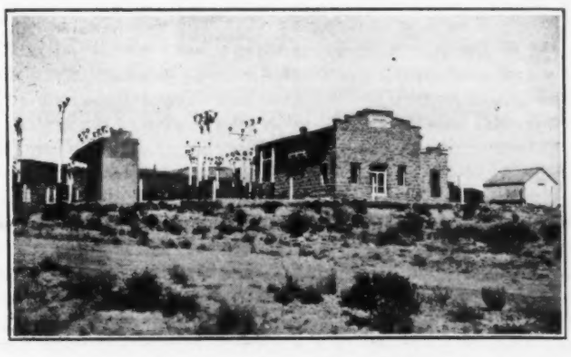


FIG. 62—SUBSTATION AT GOLDFIELD

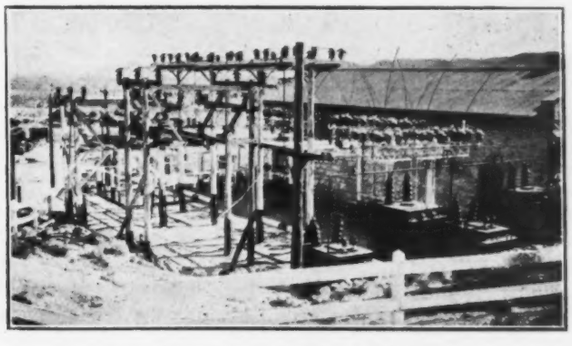


FIG. 63—SUBSTATION AT TONOPAH

switch. The line leading to Tonopah is controlled by a Kelman oil switch. There is also a line leading from this station bus through a Kelman automatic switch to Manhattan, a distance of 38 miles. The Miller's substation contains three 500-kw, 50,000-volt to 2200-volt Westinghouse self-cooled transformers equipped with

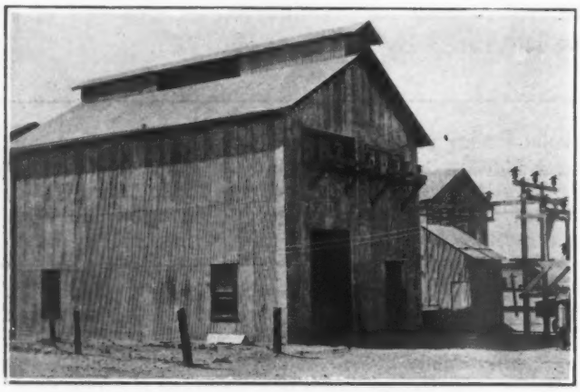


FIG. 64—SUBSTATION AT MILLER'S

cooling coils. The switchboard has one receiving panel and two feeder panels controlling the circuits to the mill in the immediate vicinity. The line is protected at this point by a General Electric electrolytic lightning arrester.

Manhattan Substation

The line extends from the Miller's substation to Manhattan and is of No. 0 seven-strand aluminum. This line is on 35-ft. poles and, as on all the other Nevada lines, the poles are spaced seventeen to the mile. The Manhattan substation is one-half mile from the mining town of Manhattan, and the line enters the station through a 55,000-volt Kelman oil switch, the transformer leads being connected directly to the switch terminal. There are three 300-kw Stanley self-cooled transformers equipped with water-cooling coils for hot-weather conditions installed within the building. The voltage is lowered to 6600. The transformation is star to star, giving 11,000 volts on the secondary, at which tension the mines at Round Mountain, another mining town 13 miles distant from the substation, are supplied. A three-phase Westinghouse automatic regulator controls the secondary voltage.

The distributing system supplied by the Manhattan

FIG. 65—SUBSTATION AT MANHATTAN

substation consists of two three-phase, 11,000-volt motor circuits and one 6600-volt, single-phase lighting circuit. At first the 11,000-volt circuits were operated with ungrounded neutral, but considerable trouble was experienced with static, and to do away with this the neutral was grounded through the primary winding of a 5-kw, 2200-volt transformer, the secondary of which was short-circuited through a suitable resistance. This method of grounding the neutral through a resistance was found very satisfactory indeed, since it was an easy matter to introduce sufficient resistance in the 220-volt secondary of the transformer, and the same could be easily changed at will. The 6600-volt, single-phase lighting circuit was, of course, supplied by making connection directly to one outside leg of the 11,000-volt system and with the neutral.

The substation building is a substantial structure of reinforced concrete, of Spanish Mission design, with comfortable living quarters for the attendant. There is a set of 55,000-volt General Electric electrolytic lightning arresters in the building, but arrangements are now being made to take them out and put them in a separate building. Fig. 65 is a general view of the station. The distributing circuits all leave the station on the side not shown on the photo, and each circuit is protected with Bowie outdoor-type lightning arresters.

Rhyolite Substation

The line that feeds the Rhyolite district taps the trunk lines at the Palmetto switch station before described. This branch is 72 miles in length and consists of No. 0 seven-strand copper on 35-ft. cedar poles spaced seventeen to the mile. The substation for this district is 1½ miles from the mining town of Rhyolite. The building is of concrete walls and steel roof and contains three 300-kw Stanley 50,000-volt to 6600-volt transformers. This station also has comfortable living quarters for the attendant and his family. The high-tension line is protected at this point with a set of General Electric lightning arresters in a separate building. The 6600-volt distrbuting system supplies the mining district for a radius of 8 miles from the substation.

Storage-Battery Car for Pennsylvania Railroad

A successful demonstration of Edison storage-battery car operation was conducted recently over the main line of the Pennsylvania Railroad from Newark to Holmesburg Junction. The trial trip was taken by a number of representatives of the Pennsylvania Railroad and other prominent railroads. The car used for the demonstration was a double-truck accommodation passenger, baggage and smoking car which had been ordered by the Lorain, Ashland & Southern Railway, Ashland, Ohio, from the Railway Storage Battery Car Company, New York, and at the time of the test was on its way to be delivered to the railway company as a second storage-battery rolling-stock equipment for that line.

The demonstration car made the 69-mile trip between Newark and Holmesburg Junction successfully in two hours and thirty-two minutes actual running time, not including stops made at Trenton and Bristol for the purpose of letting passengers off. The average running speed of the car, 27 miles per hour, was very creditable in view of the fact that forty-four passengers were on board, and especially that, owing to a short-circuited motor, the run was made with only three 20-hp motors. This car will be operated experimentally for about thirty days on the 3.8-mile Holmesburg Junction-Bustleton branch of the Pennsylvania Railroad, after which two new storage-battery cars will probably be operated on the regular passenger service of the branch. At the end of about six months, if this operation proves successful in reliability and in saving in car-mile costs, it is likely that from fifty to seventy-five storage-battery cars will be adopted by the Pennsylvania Railroad for general branch-line service.

Distributing Potential Over a String of Insulators

Experimental determination of the differences in the potential between the successive units on a high-tension line—Effect of corona. By J. L. Brenneman and Harold M. Crothers

WHEN the suspension type of insulator was first brought out it was generally supposed that the limit of the voltages which could be used on a transmission line was fixed only by the number of these units which might be placed in series. But later tests showed that the flash-over voltage of a string of insulators did not increase directly with the number of

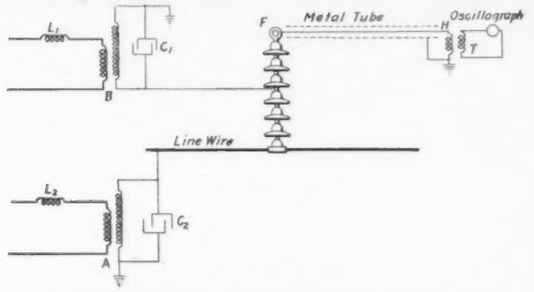


FIG. 1—ARRANGEMENT OF APPARATUS FOR THE PURPOSE OF VOLTAGE TESTING

units in the string. A more careful consideration of the nature of the electrical phenomena shows that such must necessarily be the case.

At the peak of the voltage wave all the units are at a potential above ground except the cap of the upper one. There will be a displacement from each metallic cap and pin to the surfaces at ground potential. The displacement current through the dielectric of any insulator is less than that through the unit next to it toward the line by the displacement current to ground from the connecting pin between the two. Thus the displacement current through the grounded insulator may be very much less than that through the line insulator. If the capacities of the units regarded as condensers are all the same, the potential differences across the successive units will be proportional to the displacement currents through them.

What these differences of potential across the successive units are, however, has never been accurately calculated because of the complexity of the electrostatic fields. The problem of determining them experimentally was undertaken by the authors at the University of Wisconsin in 1913, under the direction of Professor Bennett.

Method and Apparatus

The manner of obtaining the results may be outlined briefly as follows. One high-voltage transformer was used to impress a constant potential of about 40 kv on a string of six insulators. By means of a specially designed instrument transformer and an oscillograph it was found possible to measure quite accurately the small current through the ground insulator and thus to obtain an indication of the voltage across it. Now a lead was brought from another high-potential transformer to the cap of some intermediate insulator in the string, the other terminal of the transformer being connected to the grounded end of the string. The voltage of this second transformer was adjusted until the voltage across the grounded insulator was the same as before, thus showing that the second transformer was not disturbing the normal distribution of voltage in the string. The secondary voltage of this transformer was then recorded as the potential of that cap above ground, and the operation was repeated at the cap of each insulator in turn.

The arrangement of the circuits is shown in Fig. 1. Transformer A was used to impress the potential on the string of insulators. This transformer, which was designed for experimental work in the university laboratory, had a range of 300 kv. Transformer B, a 50-kv unit, was connected to the cap of some other insulator as shown. The secondary voltages of both of these were calculated from the primary voltages by the ratios of transformation under the loads used.

The inductance coils L_1 and L_2 and the condensers C_1 and C_2 were placed in the circuit as shown in order to suppress harmonics in the wave-form so that the current through the insulators could be accurately read on the oscillograph.

The lead H from the insulator to the instrument transformer T was shielded by a grounded metal tube in order to cut off any possible displacement current from the high-tension conductor and surfaces directly to the lead. The cap of the grounded insulator was also shielded by lead foil for the same purpose.

Readings of current were taken on the tracing table of the oscillograph. A tracing cloth ruled in millimeters was used and the calibration constant was defined as the current in root-mean-square milliamperes per millimeter double deflection. To calibrate the instrument the vibrator was put in series with a voltmeter which served as an ammeter.

Grounded Shield for Oscillograph Lead

The conductor H from the cap of the grounded insulator to the oscillograph was about 18 ft. long. It could not be used exposed, as the high-potential lead and surfaces would produce displacement currents to the grounded lead. These would be measured in the oscil-

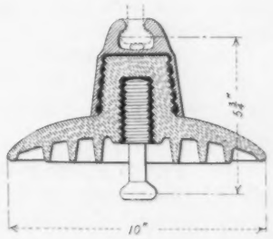


FIG. 2—SECTION OF INSULATOR

lograph but would not be due to any property of the insulator, and hence would cause an error in the observations. Grounded metal tubes were therefore used to intercept these currents and conduct them to ground.

Before making any measurements on the insulators it was thought desirable to investigate the possibility of any other stray displacement currents which might

produce erratic results. The insulators were removed from the supporting button *F*, leaving the oscillograph and the instrument transformer connected only to the button. A high-potential line was hung 10 in. below the button. With 16 kv on the line a barely perceptible current was observed in the oscillograph. When the lead *H* was disconnected from the button and pulled back entirely within the shield no current was observed, showing that the conductor itself was effectively shielded. By means of lead foil the shield was extended to the supporting button and the cap of the grounded insulator. At one time the current transformer was also shielded in a like manner, but with no noticeable effect since the exposed surface was small and the distance from the high-potential surfaces was great. Most of the readings were taken without this shield.

As a result of these precautions the currents measured in the oscillograph were actual currents through the body of the insulator and therefore could be used

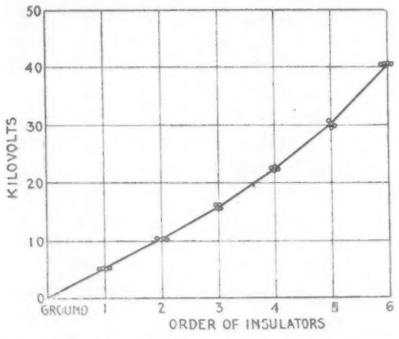


FIG. 3—VOLTAGE OF EACH CAP ABOVE GROUND

as an accurate indication of the voltage across the grounded unit of the string. This fact is the foundation of the work done in this test.

Suppression of Harmonics

When the voltage from the transformer was first impressed on the insulators the current wave was found to contain harmonics of such magnitude that any attempt to locate positive and negative peaks would be mere guesswork. Energy was obtained from a large turbo-alternator. While the voltage wave apeared to be a smooth sine curve, there are small ripples in it which are greatly magnified in the current wave taken by a capacity reactance such as an insulator. The harmonics were weeded out by the use of the air-core inductors and the Leyden jars, as shown in Fig. 1. The reactances were proportioned so as to admit the third harmonic freely, since it is required in the exciting current of the transformer, while the higher harmonics were repressed by the inductance. The effectiveness of this arrangement is shown by the oscillograms, which are discussed later.

Capacity of the Insulators

All of the insulators used during this test were of the same make and type. Fig. 2 shows a section through one of them. Six of them were used, and each was numbered for the purpose of identification throughout the test.

Before the insulators were used together in a string the capacity of each one alone was determined in order to obtain an idea of their uniformity. Each was used alone under three voltages ranging from 15 kv to 30 kv. From the readings of current frequency and voltage the capacity could be calculated. Table I shows the values observed. It will be noted that four of the insulators have the same capacity within 1 per cent and that the other two fall below by about 5 per cent. In the table the insulators are given in the same order in which they were used in the string.

All of these readings were taken without the lead-foil sheath around the cap of the insulator, and therefore the figures given include the internal capacity of the insulator and also that between the line and the outside of the cap. A determination of the internal capacity alone of insulator No. 1 gave a value of 2.50×10^{-11} farads.

Distribution of Potential

In making measurements to determine the distribution of potential in a string of insulators some precautions were taken and corrections made which call for a detailed discussion.

With the six insulators in the string and only transformer *A* connected to the line wire the insulators were

TABLE I—CAPACITY OF INSULATORS IN SERIES

Insulator Number	Capacity in Farads $\times 10^{-11}$
1 (ground)	2.99
2	3.00
3	3.01
5	2.99
4	2.90
6 (line)	2.85

under normal working conditions. Each insulator assumed a certain proportion of the total voltage, and the cap of each insulator was at a certain normal potential above ground.

When a lead was brought from transformer *B* to the cap of the intermediate insulator in the string all these relations were disturbed. The potential of that cap to which the lead was brought was set by the transformer *B*, and the potentials of the caps of the other insulators were also influenced more or less by this transformer voltage. If the voltage of transformer *B* was set at the normal potential of the cap to which it was connected, the potentials of all the other caps also returned to their respective normal values. This fact was made use of.

The voltage of transformer *B* was adjusted until the oscillograph indicated the same voltage as was indicated when the transformer was disconnected from the cap. Or, in other words, the voltage of transformer *B* was adjusted until making or breaking the connection between it and the cap of a certain insulator produced no change in the voltage across the ground insulator. Then the secondary voltage of this transformer was the normal potential of that particular cap above ground.

Complications arose, however, from the disturbing effect of the lead from transformer *B* to the cap. The presence of this lead in the electrostatic fields surrounding the insulators obviously would disturb those fields and to that extent disturb the distribution of potentials. If the lead could have been brought in to the cap along what was normally an equipotential surface, no disturbance would result and the method would be without error. But in such complex fields this was impossible, although an attempt was made to approximate it. A method of determining the probable effect of this lead and of making a correction for it was devised, however, and will be described in the following detailed account of the operations.

First the voltage across the ground insulator was determined. With the line wire at a potential of about 40 kv, and no connection to the intermediate caps, the deflection on the oscillograph was noted. This deflection was about 16 mm and was called the "base" since

it represented normal potential across the ground insulator.

The potential of the line wire was held constant during the run by transformer *A*. After this first reading on the oscillograph transformer *B* was connected to the bottom of the fifth insulator by a No. 14 weatherproof wire, an attempt being made to bring it in along an equipotential surface. On the opposite side of the insulator an extra lead 3 ft. long was placed in as nearly similar a position as possible. The voltage of transformer *B* was adjusted until the deflection was slightly greater than the "base." After recording this voltage and deflection, the extra 3-ft. lead was removed and the transformers brought back to the same voltages with only one lead on the fifth insulator. The deflection was ordinarily about 0.4 mm less than before. These readings showed that even with a constant potential at the cap to which transformer *B* was connected the presence of the extra 3-ft. lead in the electric fields caused an increased deflection of 0.4 mm. Presumably the remaining lead produced an equal disturbance and increased deflection since it lay in a similar position on the opposite side of the insulator. Hence an allowance was made for this disturbance and the voltage of transformer *B* was adjusted until the deflection on the oscillograph was equal to the "base" plus 0.4 mm. This voltage was recorded as the normal potential of that cap above ground. The same operation was repeated at the third insulator, the fourth insulator, etc., up the string until the potential of each cap above ground had been determined.

Four separate runs were made with the same total line voltage in order to check results. In the last run the lead-foil sheath was removed from around the cap of the upper insulator. The result of this test agreed with the others quite closely.

As an additional check upon the corrections which were used in this test a further test was made. The corrections used varied from zero, when the lead was connected to the bottom of the upper insulator, to 0.4 mm, when the lead was at the bottom of the fifth. Now transformer *B* was connected alone to the heavy line wire and the deflection noted at the normal line voltage. Then the No. 14 lead was also put in at the bottom of the sixth insulator in a parallel with the line wire, and the same voltage was impressed as before. The deflection was 0.5 mm greater than before. This increase was due entirely to the presence of the No. 14 lead, and the result corresponded closely with the corrections which had been used higher up in the string. Therefore it was felt that the effect of the lead in the electric fields had been quite closely accounted for, and that the possible error from this source had been reduced to a minimum.

Results of This Test

In Fig. 3 are plotted the results of this test. Four series of tests were made with the same over-all voltage on the string in each case, and the amount of variation in the results is shown in the points plotted. The voltage of any cap above ground is plotted against the number of insulators between the cap and ground. The curve is drawn to average the points.

From the curve in Fig. 3 the values for the curve in Fig. 4 are obtained. Here the voltage across any insulator is plotted against the number of the insulator in the string. Voltages are plotted in percentages of the voltage across the ground insulator for the purpose of comparing this curve with the other curve shown on the same sheet. The increase in voltage in the insulators near the line is shown more prominently by this curve, and it will be noted that the voltage across the line insulator is 190 per cent of that across the ground insulator, or the ground insulator in this string bears about one-half of the voltage that the line insulator bears. Since break-down or flash-over occurs on the whole string when the line insulator is overstressed, it follows that the insulators near the ground will be working very much under normal voltage. In a string of nine or ten units the division of potentials would tend to become even more unequal. The presence of corona, however, at the high potentials reduces this inequality and makes the distribution of potentials more uniform, as will be pointed out later. But the results of this test indicate the difficulty of insulating for very high voltages by simply adding insulators to the string; that is, if the

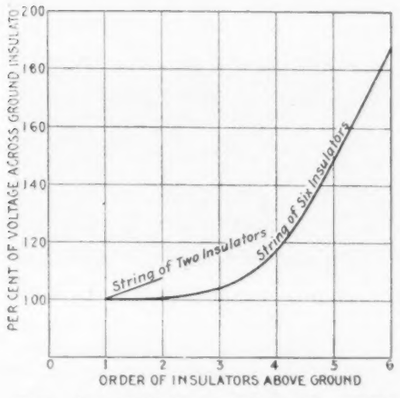
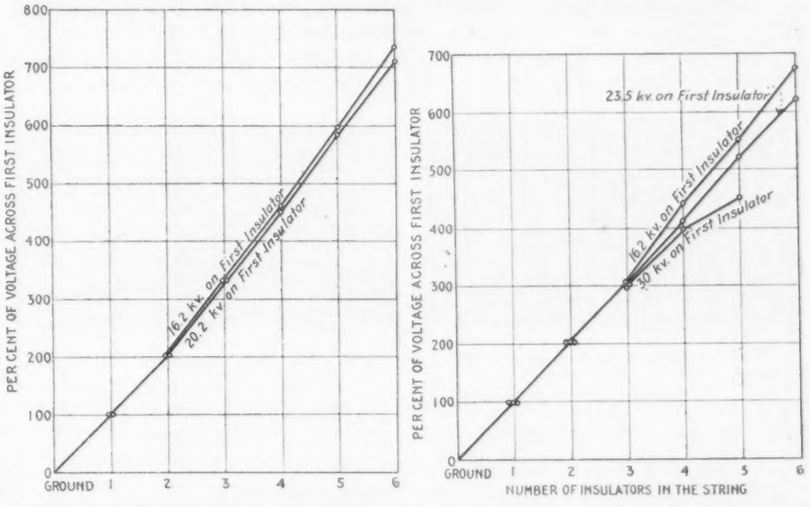

PER CENT OF VOLTAGE ACROSS GROUND INSULATOR
String of Two Insulators
String of Six Insulators
ORDER OF INSULATORS ABOVE GROUND

FIG. 4—VOLTAGE ACROSS EACH INSULATOR IN A STRING, STATED IN PERCENTAGE OF THE VOLTAGE ACROSS THE GROUND INSULATOR


PER CENT OF VOLTAGE ACROSS FIRST INSULATOR
16.2 kv. on First Insulator
20.2 kv. on First Insulator
23.5 kv on First Insulator
16.2 kv. on First Insulator
30 kv. on First Insulator
GROUND
NUMBER OF INSULATORS IN THE STRING

FIGS. 5 AND 6—EFFECT OF CORONA ON DISTRIBUTION OF POTENTIAL—LINE VOLTAGE IN PER CENT OF VOLTAGE ACROSS FIRST INSULATOR

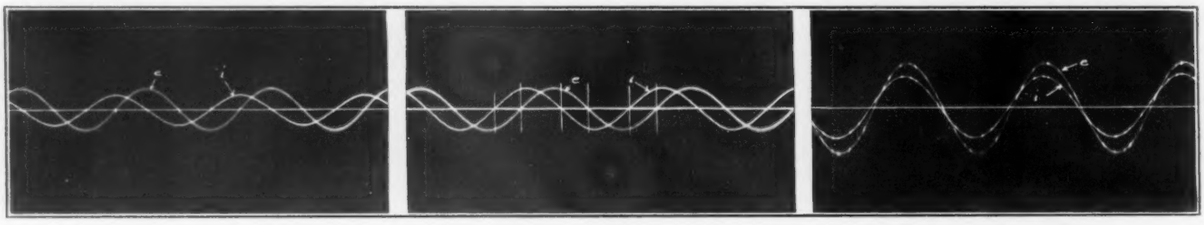
TABLE II—CAPACITY OF INSULATORS TO GROUND

Order of Cap Above Ground	Apparent Capacity to Ground in Farads $\times 10^{-12}$
6	2.16
5	2.07
4	1.35
3	0.55
2	0.26

insulators are all uniform. It would be interesting to repeat this test on a string of insulators which was made up of two different types or patterns and in which the insulators near the ground had higher capacity reactance that those near the line.

In Fig. 4 is plotted also the curve for a string of two insulators. The data for this curve were obtained in a slightly different manner from those for the other. One insulator was hung up alone, working voltage was impressed, and a reading of the oscillograph was made. Then another insulator was added to form a string, and the line voltage was increased until the oscillograph showed that the ground insulator was under the same voltage as before. The line voltage then was the voltage across the two units, and the test was complete. A comparison of this curve with the other shows that there is a changing ratio between the voltages across the first and second insulators as others are added to the string. To state it exactly, in a string of six insulators the voltage across the second is 101 per cent of that across the first, while in a string of two insulators the ratio is 108 per cent. This change is caused by the change in the effect of the line wire and the other high-potential surfaces upon the two. One would expect a similar run was made, keeping 20.2 kv across the ground insulator. The two curves were plotted as in Fig. 5, the line voltage being plotted in percentage of the voltage across the ground insulator in each run for the purpose of comparing them more easily. It will be noted that the curves are identical up to the point at which corona began to appear. From there on the curve at the higher voltage, and the one on which corona appeared first, lies below the other one. This means that the presence of corona reduces the ratio between the line voltage and that across the ground insulator. Evidently corona has the effect of increasing the conducting surfaces of the insulators near the line and thus increasing their capacity. Thus corona tends to grade automatically the capacities of the insulators in a string under very high voltages and thus even up the distribution of potentials. This effect may be quite marked in some very high-tension transmission lines.

The curves in Fig. 5 do not show the magnitude of this effect, for the voltages did not differ widely enough. Corona appeared in both tests, and the curves show only the differential effect. To bring it out more strongly Fig. 6 is presented, for which three tests were made, beginning with 16.2, 23.5 and 30 kv on the first insulator. In these tests the lead-foil sheath was not used around the cap of the ground insulator. Since all the tests were made under the same conditions, however, this fact should not affect the conclusions drawn. Here as before the curves are identical up to the point at which corona began to appear. Then the curves at the higher voltage fall below. A quite marked effect is shown in these curves.



FIGS. 7, 8 AND 9—DISTRIBUTION OF POTENTIAL OVER A STRING OF SUSPENSION INSULATORS

curve for three or four insulators to lie somewhere between the two already shown.

Apparent Capacity of the Caps to Ground

In the *Proceedings* of the American Institute of Electrical Engineers for May, 1912, Mr. F. W. Peek developed formulas for calculating the voltage on any insulator in a string. The assumption is made that each insulator cap had the same capacity to ground. It is now possible to check this assumption by calculating the apparent capacity of each cap to ground. For instance, the voltage across the sixth insulator is 10.1 kv. From the value of capacity of the insulator the current through it is found to be 0.116 milliamp. Likewise the current through the fifth insulator is 0.0905 milliamp, and the current from the cap to the ground is 0.025 milliamp. The voltage between the cap and ground is 30.2 kv, so the apparent capacity between this cap and ground is 2.16×10^{-12} farads. The other values as calculated are given in Table II.

The results shown in Table II do not support the assumption of constant capacity to ground. The apparent capacity to ground is a measure of the displacement current which takes place from the cap to ground. From this fact can be concluded that the strong electric fields from the line and high-potential surfaces repress the currents to ground from the insulators near the ground.

Effect of Corona Upon the Distribution of Potential

In order to show the way in which a corona discharge on the surface of the insulator around the pin affects the distribution of voltages, one insulator was hung up alone and the deflection of the oscillograph was found for 16.2 kv. Then insulators were added one at a time and at each step was found the line voltage which would give the same voltage across the ground insulator. A

Discussion of Oscillograms

During the tests some oscillograms were taken which also present interesting facts. Fig. 7 shows the wave of voltage impressed on the primary of the high-tension transformer and the wave of the current through a single suspension unit. The shape of the current wave is to be noted as showing the effectiveness of the inductance coils and the Leyden jars in weeding out the harmonics. Measurements on the oscillogram show that the voltage and current waves are practically 90 deg. out of phase. This means that the current is nearly all displacement current and that the leakage current is negligible in comparison. The insulator was dry when this oscillogram was taken.

The waves of Fig. 8 were observed with the insulator under spray from a nozzle which was directed down at an angle of 45 deg. and delivered a fine mist. The precipitation was at the rate of 0.6 in. in five minutes. In this case the current leads the voltage by only 70 deg. From the calibrations the total current is found to be 0.287 milliamp. The displacement current then is 0.27 milliamp and the capacity reactance is 68 megohms. The capacity reactance of the dry insulator is 87 megohms. The increase in capacity when the insulator is wet is due to the increased conducting surfaces. By calculating the leakage component of the current the resistance of the insulator under spray is found to be 82 megohms.

The curves of Fig. 9 were obtained with the insulator under the spray and the axis horizontal. The whole surface is wet when the insulator is in this position, and the leakage current is greatly increased. The angle of lead is 9 deg. The total current is 0.416 milliamp and the leakage current is 0.41 milliamp. The resistance is only 8 megohms. This shows the great drop in resistance when the whole surface is wet. The capacity reactance undergoes a further decrease from 68 megohms to 50 megohms, as would be expected.

Summary

From Figs. 3 and 4 it is seen that with a total emf of 40 kv impressed on a string of six insulators the voltage across the line unit is 190 per cent of that across the ground unit. The ratio of voltages between any two insulators changes with the number of units in the string.

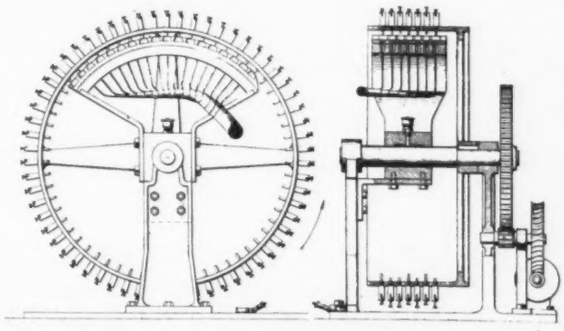
The formation of corona increases the effective capacity of the insulators nearest the line, thus automatically grading the insulators and tending to equalize the voltages across the different units.

When dry, practically all of the current through the insulator is displacement current. Under spray with the axis vertical the leakage current becomes equal to about one-third of the total. Under spray with the axis horizontal the leakage current greatly exceeds the displacement current.

Talking Sign with Changeable-Letter Feature

Mr. Siegfried Held, Chicago, inventor of a water-sterilizing apparatus, has now patented an electric talking sign which he claims has advantages over other similar devices. The sign proper consists of a bank of lamps arranged in horizontal and vertical rows like those of motograph signs. From each lamp a single conductor is taken to a stationary connection board, shown at the top of Fig. 1. Revolving outside of this connection board is a drum carrying adjustable contactors arranged to complete the lamp circuits as they slide over the contact board. The drum is driven through a gear train by means of a fraction-horsepower motor.

Changes of reading matter on the sign are accomplished by raising and lowering the contactors on the revolving drum. As can be seen in Fig. 2, each projecting pin is designed so that if it is lifted up and turned slightly it will not return to its original position. When a projecting pin is in the "down," or contact-making, position it is held in place by a spiral spring placed between the pin and its jacket housing. With contact pins of this design it is said that changes in the text of the sign may follow one another with great rapidity.



FIGS. 1 AND 2—SIDE AND FRONT ELEVATIONS OF REVOLVING DRUM AND CONNECTING BOARD

INTERIOR WIRING RULES COMPARED

An Outline of the Regulations Followed in the United States, Germany and England

In the accompanying illustrations are shown the results of a comparative study of the wiring rules followed in the United States, Germany and England, as prepared by Mr. Hugo Eisenmenger, Cleveland, for the National Electric Light Association committee on the wiring of existing buildings, of which Mr. R. S. Hale, Boston, is chairman. These curves are based on the data taken from the rules compared in the "parallels" given on pages 1100-1107 in this issue. The rules not there included deal with features having no relation to ordinary inside wiring installations. In Fig. 1 the carrying capacities for European countries apply to all types of insulation, including rubber. On pages 1107 and 1108 are tables showing the requirements of insulation resistance in ordinary indoor installations. It will be noted that Continental rules are much less strict than those of the United States and England.

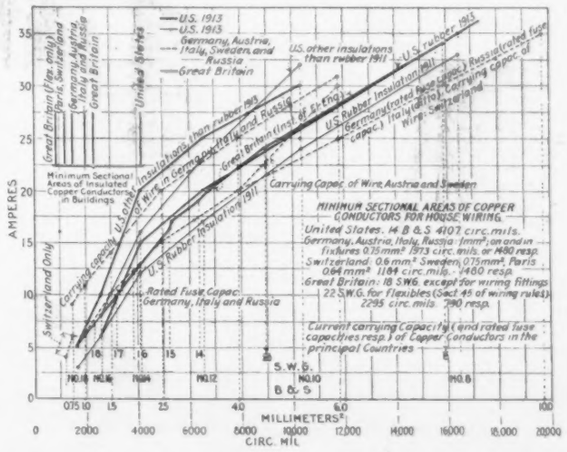

AMPERES
MILLIMETERS²
CIRC. MIL
MINIMUM SECTIONAL AREAS OF COPPER CONDUCTORS FOR HOUSE WIRING
Current carrying Capacity (and rated fuse capacities resp.) of Copper Conductors in the principal Countries
Rated fuse Capac. Germany, Italy and Russia
Carrying Capac. of Wire, Austria and Sweden
Switzerland Only
United States

FIG. 1—CURRENT-CARRYING CAPACITIES OF CONDUCTORS

Rules used: United States, National Electrical Code; Germany, Vorschriften des Verbandes deutscher Elektrotechniker; Great Britain, Wiring Rules of the Institution of Electrical Engineers; Austria, Sicherheitsvorschriften des Elektrotechnischen Vereines in Wien; Switzerland, Vorschriften des Schweizerischen Elektrotechnischen Vereines; Russia, Rules of the Permanent Committee of the Russian Congress for Electrical Engineers; Italy, Norme per l'Esecuzione e l'Esercizio degli Impianti Elettrici; Sweden, Lag, Innefattande Vissa Bestämmelser om Elektriska Anläggningar (of June 27, 1902); Paris, Règlement sur les Installations d'Eclairage Electrique (Comité de l'Union des Secteurs Electriques Parisiens).

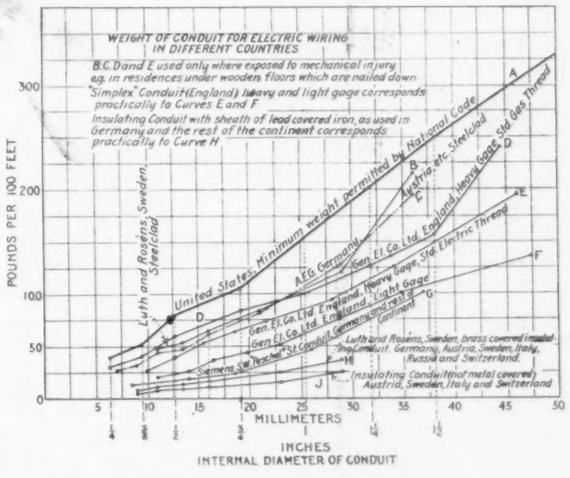


FIG. 2—WEIGHT OF CONDUITS

Comparison of the American Wiring Rules with the German and English Rules

BY HUGO EISENMENGER

United States, National Electrical Code.
Germany, Vorschriften des Verbandes deutscher Elektrotechniker.
Great Britain, Wiring Rules of the Institution of Electrical Engineers.

All Systems and Voltages—Inside Work—Wires

UNITED STATES	GERMANY	ENGLAND
16a. Must not be of smaller size than No. 14 B. & S. gage except as allowed for fixture work and pendent cord (fixture low-potential, Sec. 26v, not smaller than No. 18 B. & S.). B. & S. No. 14, 4107 circ. mil.; No. 18, 1624 circ. mil.	20.3. Insulated wires (in conduit) or on insulators the distances between which do not exceed 1 m (39 in.) minimum section, 1 mm², 1970 circ. mil.; on and in fixtures, 0.75 mm², 1475 circ. mil.	32. Excepting for wiring fittings the sectional area of any copper-conductor must not be less than that of No. 18 S. W. G. (2291 circ. mil.). 45. Flexibles must be of a sectional area not less than that equivalent to No. 22 S. W. G. (789 circ. mil.), and they must be made up of wires twisted together on a short lay, the sectional area of each wire being not greater than that of No. 36 S. W. G. (58 circ. mil. or .0076 in. diam.). 33. The minimum size of the conductors within a building will be determined as follows: (a) For lighting circuits, by the permissible drop in volts, which under ordinary conditions must not exceed 2 per cent plus a constant allowance of 1 volt (figured out in tables).
16b. Tie wires must have an insulation equal to that of the conductors they confine, and may be used in connection with solid knobs for the support of wires of size No. 8 B. & S. gage or over. Solid knobs or strain insulators must be used for all wires at the end of runs where conductors are terminated. Split knobs or cleats must be used for the support of conductors smaller than No. 8 B. & S. gage, except at the end of runs. Knobs or cleats which are arranged to grip the wire must be fastened by either screws or nails. If nails are used they must be long enough to penetrate the woodwork not less than one-half the length of the knob and fully the thickness of the cleat, and must be provided with washers which will prevent, under reasonable usage, injury to the knobs or cleats.	25.2. Multiple conductors shall not be fastened in such a way that the conductors are pressed towards each other. Metal tie-wires are not suited for unarmored multiple conductors.	
16c. Must be so spliced or joined as to be both mechanically and electrically secure without solder. The joints must then be soldered unless made with some form of approved splicing device and covered with an insulation equal to that on the conductors.	21i. The joining of conductors and the branching off must be made exclusively by soldering, screwing or an equivalent joint. (Expl. to rule: An equivalent connection would be, e.g., a cover of tough metal pushed over the wire-ends and twisted together with them or the riveting connector. Simply twisting the wires around each other is not permissible.) 21.14. Flexibles or cables up to 6 mm² (7638 circ. mil.) and solid wires up to 25 mm² (31,825 circ. mil.) may be connected to the apparatus by means of eyes bent out of the conductor. Cables over 6 mm² section (7638 circ. mil.) or solid wires above 25 mm² (31,825 circ. mil.) shall be provided with lugs or equivalent joints. Stranded wires and flexibles of any kind shall, as a rule, have the wires of every conductor soldered together at the end if they are not provided with lugs. 21.15. The connections of flexibles among each other and the branches from the same shall be made with screws on insulating bases or equivalent appliances. On and in fixtures soldering is permissible also for flexible wires if the voltage to earth does not exceed 250 volts.	72. Joints constitute a source of weakness and should be avoided wherever possible. They must be accessible and be mechanically and electrically perfect to prevent heat being generated. They must be soldered except where flexibles are connected to hard wires (see par. 53 below). Soldering fluids containing acids or other corrosive substances must not be used. Connections between conductors should preferably be made in junction boxes. 53. Connections between flexibles and hard wires may be effected only by means of screw terminals in junction boxes, porcelain or other connecting boxes, or ceiling roses, and not by soldering; and where flexibles from fittings unavoidably pass into ceilings they must be inclosed in conduits terminating in metal junction boxes. 74, 75, 76 and 77 give further instructions about joints, how the dielectric and braid, etc., should be handled in making joints, etc.
16c. cont. Stranded wires (except in flexible cords) must be soldered before being fastened under clamps or binding screws, and, whether stranded or solid, when they have a conductivity greater than that of No. 8 B. & S. gage they must be soldered into lugs for all terminal connections, except where an approved solderless terminal connector is used.	(See 21.14 above.)	
16d. Must be separated from contact with walls, floor timbers or partitions through which they may pass by non-combustible, non-absorptive insulating tubes, such as glass or porcelain, except at outlets where approved flexible tubing is required. Bushings must be long enough to bush the entire length of the hole in one continuous piece, or else the hole must first be bushed by a continuous waterproof tube. This tube may be a conductor, such as iron pipe, but in that case an insulating bushing must be pushed into each end of it, extending far enough to keep the wire absolutely out of contact with the pipe.	24d. The wires must be passed through walls, ceilings and floors in such a way that they are sufficiently protected against humidity, mechanical and chemical injury and conduction along the surface. 24.1. The ducts shall either correspond to the method used in the corresponding localities or durable insulating tubes shall be employed in such a way that for every single conductor or multiple conductor a separate tube is used.	69. Where conductors pass between partitions or under floors, they must be protected in accordance with pars. 49 or 50 or 51 (metal conduit or wood casing or armored conductors). 70. Conductors where exposed to injury, e.g., where passing through walls, partitions or ceilings, must be inclosed in porcelain or other protecting conduits. 71. Conductors passing through party walls or fire-resisting floor must be provided with special protection, such as a close-fitting porcelain or other incombustible tube, to prevent the spread of fire. When the end of the tube is outside the building, it must be bell-mouthed or bushed, and turned downwards.
16e. Where not inclosed in approved conduit, molding or armored cable, and where liable to come in contact with gas, water, or other metallic piping or other conducting material, must be separated therefrom by some continuous and firmly fixed non-conductor creating a permanent separation, etc.	21n. Where current-carrying conductors cross each other or cross metal parts these crossings are to be made in such a way that contact is impossible.	26. There must be no contact between conductors (or their insulating material, metallic sheathing or tubing, whether earthed or not) and gas pipes. Non-conducting distance pieces must be used where necessary.

All Systems and Voltages—Inside Work—Wires

UNITED STATES	GERMANY	ENGLAND
16f. Must be so placed in wet places that an air space will be left between conductors and pipes in crossing and the former must be run in such a way that they cannot come in contact with the pipe accidentally. Wires should be run over, rather than under pipes upon which moisture is likely to gather, or which, by leaking, might cause trouble on a circuit.		
18. Table of allowable carrying capacities of wires— (See curve sheet.)	(See curve sheet.)	(See curve sheet.)

Switches, Cutouts, Circuit Breakers, Etc.

UNITED STATES	GERMANY	ENGLAND
19a. On constant potential circuits all service switches and all switches controlling circuits supplying current to motors or heating devices and all fuses unless otherwise provided* must be so arranged that the fuses will protect and the switches disconnect all of the wires.	11d. All switches for current-consuming devices must, when opened, disconnect all poles of their circuit which are under tension against earth. Low voltage switches (250 volts to earth) serving smaller groups of incandescent lamps are not subject to this rule. 11.3. As smaller groups of incandescent lamps are counted such groups as do not have to be fused with more than 6 amp (par. 14.7) and do not contain more than 15 lamps in multiple.	17. Every system not being an earthed concentric system must be protected by linked main switches or linked switch-fuses under the control of the consumer, and these must be easily accessible and placed as near the generator or the entry of supply as circumstances permit.
*Exceptions as to switches, motors of ¼ hp or less and heaters of 660 watts and less where single pole switches are permitted; exceptions as to fuses. In 23a fuses may be omitted in grounded neutrals, provided the neutral is of equal carrying capacity to the larger of the outside wires.	11f. It must not be possible to switch off grounded neutrals otherwise than together with their respective outer conductors (except in such rooms as are intended essentially for the operation of electrical machinery or apparatus, and are ordinarily accessible only to instructed persons.) 14d. Conductors must be protected by fuses or automatic cutouts. (On purpose definite prescriptions are avoided that fuses must be double pole, but it is universally recognized that every pole must be fused, barring grounded conductors.)	22. Where energy is taken from all the conductors of a two-phase or three-phase system, the conductors must be protected, either by an automatic triple-pole circuit-breaker, or by a fuse on each pole in conjunction with a triple-linked switch, or by three switch-fuses.
		24. Every subcircuit must be protected on each pole by a fuse.
		19. Where one of the main conductors of a system of supply is earthed, no interruption of the current is permitted at any point in a conductor connected to the earthed main, unless a simultaneous break is effected on the non-earthed conductor. No switch or switch-fuse not linked to another switch or switch-fuse on the non-earthed conductor may be inserted in any conductor connected to an earthed main. This rule does not prohibit the use of a link for testing purposes or a switch for use in connecting a generator.
		20. No fuse may be placed in the neutral conductor of a multiple-wire system, but fuses must be placed on both conductors of two-wire circuits branching therefrom. This does not prevent the use of a disconnecting link in the neutral conductor for testing purposes.
19b. Switches, cutouts, etc., must not be placed where exposed to mechanical injury nor in the immediate vicinity of easily ignitible stuff, etc.		87f. In positions where switches and circuit-breakers are liable to injury, or to contact with goods, they must be further protected by an open-fronted box or other suitable guard.
19c. They must, when exposed to dampness, either be inclosed in a moisture-proof box or mounted on porcelain knobs. The cover of the box must be so made that no moisture which may collect on the top or sides of the box can enter it.	31.3. Apparatus shall, where possible, not be placed in moist rooms. If this is unavoidable, care shall be taken to provide particularly good insulation, good protection against personal contact and against the injurious influences of moisture.	30. Except where completely inclosed in a metallic casing, no switch, ceiling-rose, cutout, plug-connector, or other electrical accessory, may be mounted directly upon any surface liable to become damp, but must, in addition to its own mount, be fixed upon a base block rendered impervious to moisture.

Constant Potential—Automatic Cutouts

UNITED STATES	GERMANY	ENGLAND
23a. Must be placed on all service wires, either overhead or underground, in the nearest accessible place to the point where they enter the building and inside the walls, and arranged to cut off the entire current from the building. Where the switch required by No. 24a is inside the building the cutout required by this section must be placed so as to protect it.	14d. Conductors must be protected by fuse cutouts or by circuit breakers. 14e. Cutouts must be placed on all such places where the cross-section of the conductors is diminished towards the place of consumption. The cutout must be situated as close as possible to the place of diminution of cross-section area. * * * 14.6. In case of branches the connecting piece between the main line and the fuse can have a smaller cross-section than the main line if its single length is not more than 1 m (39 in.) provided it is separated in a fire-safe way from inflammable objects and provided that it does not consist of multiple conductors. 14f. In case of reduction of cross-section where the preceding cutout protects the smaller cross-section, further cutouts are not required.	17. Every system not being an earthed concentric system (par. 58) must be protected by linked main-switches under the control of the consumer, and these must be easily accessible and placed as near the generator or the entry of supply as circumstances permit.
For three-wire (not three-phase) systems the fuse in the neutral wire may be omitted, provided the neutral wire is of equal carrying capacity to the larger of the outside wires and is grounded.	14g. Lines which are grounded under regular operation conditions must in general not be provided with fuses. 14.9. The neutral conductors of multiple wire or multiple phase systems shall, as a rule, not be fused. An exception of this rule is insulated lines branching off from a neutral conductor and forming part of a two-wire system. If a system of that kind is fused single-pole only the branches from the neutral shall be marked as such.	20. No fuse may be placed in the neutral conductor of a multiple-wire system, but fuses must be placed on both conductors of two-wire circuits branching therefrom. This does not prevent the use of a disconnecting link in the neutral conductor for testing purposes.
23b. Must be placed at every point where a change is made in the size of wire (unless the cutout in the larger wire will protect the smaller).	14e. Cutouts must be placed on all such places where the cross-section of the conductors is diminishing towards the place of consumption. 14f. In case of reduction of cross-section where the preceding cutout protects the smaller cross-section, further cutouts are not required.	24. Every subcircuit must be protected on each pole by a fuse.
For three-wire direct-current or single-phase systems the fuse in the neutral wire, except that called for under 23d, may be omitted, provided the neutral wire is grounded as provided for in No. 15.	14g. Lines which are grounded under regular operation conditions must in general not be provided with fuses. 14.9. The neutral conductors of multiple wire or multiple phase systems shall, as a	20. No fuse may be placed in the neutral conductor of a multiple-wire system, but fuses must be placed on both conductors of two-wire circuits branching therefrom. This does not prevent the use of a

Constant Potential—Automatic Cutouts

UNITED STATES	GERMANY	ENGLAND
	rule, not be fused. An exception to this is insulated lines branching off from a neutral conductor and forming part of a two-wire system. If a system of that kind is fused single-pole only the branches from the neutral should be marked as such.	disconnecting link in the neutral conductor for testing purposes.
	14.5. In low-tension plants the fuses shall be placed in a location where they are easily accessible to those in charge; it is recommended to centralize them as much as possible.	24. Every subcircuit must be protected on each pole by a fuse.
23c. Must be in plain sight, or inclosed in an approved cabinet, and readily accessible. They must not be placed in the canopies or shells of fixtures. Link fuses may be used only when mounted on approved slate or marble bases and must be inclosed in dust-tight, fire-proofed cabinets, except on switchboards.		79. Switch and fuse boards must be so constructed and placed that all their parts which may have to be adjusted or handled are readily accessible.
		89f. Fuses must not be placed in plug connectors, ceiling roses, or lampholders.
23c. cont. Link fuses may be used only when mounted on approved bases and must be inclosed in dust-tight, fire-proofed cabinets, except on switchboards.		90. Branch fuses must be grouped together in accessible positions in sight, and they should be symmetrically placed and labeled for each circuit.
		From 89b: The use of fuses of the inclosed type is recommended.
		89d. The bases must be of incombustible, non-conducting and moisture-proof material.
		89e. Unless placed in a compartment specially arranged for the purpose, or in engine-rooms in positions where no danger is likely to arise when a fuse operates, fuses must be provided with covers to retain the fused metal. These covers must be of incombustible material, and must either be non-conducting or of rigid metal lined with insulating incombustible material, and clear of all live parts. Small close-fitting covers must be suitably ventilated.
23d. Must be so placed that no set of small motors, small heating devices or incandescent lamps, whether grouped on one fixture or on several fixtures or pendants (not more than 16 sockets or receptacles) requiring more than 660 watts, will be dependent upon one cutout. By special permission, in cases where wiring equal in size and insulation to No. 14 B. & S. gage approved rubber-covered wire is carried direct into keyless sockets or receptacles, and where the location of sockets and receptacles is such as to render unlikely the attachment of flexible cords thereto, the circuits may be so arranged that not more than 1320 watts (or 32 sockets or receptacles) will be dependent upon the final cutout. Except for signs and outline lighting, sockets and receptacles will be considered as requiring not less than 40 watts each. All branches or taps from any three-wire system which are directly connected to lamp sockets or other translating devices must be run as two-wire circuits if the fuses are omitted in the neutral or if the difference of potential between the two outside wires is over 250 volts, and both wires of such branch or tap circuits must be protected by proper fuses. * * * When 1320 watts are dependent upon one fusible cutout, as is allowed in theater wiring, outline lighting and large chandeliers, the fuses may be in accordance with the following table: 125 volts or less..... 20 amperes 125 to 250 volts..... 10 "		
	14.9. The neutral conductors of multiple wire or multiple phase systems shall, as a rule, not be fused. An exception to this rule is insulated lines branching off from a neutral conductor and forming part of a two-wire system. If a system of that kind is fused single-pole only the branches from the neutral shall be marked as such.	20. No fuse may be placed in the neutral conductor of a multiple-wire system, but fuses must be placed on both conductors of two-wire circuits branching therefrom. This does not prevent the use of a disconnecting link in the neutral conductor for testing purposes.
23e. The rated capacity of fuses must not exceed the allowable carrying capacity of the wire as given in No. 18. * * * Fixture wire or flexible cord of No. 18 B. & S. gage will be considered as properly protected by 6-ampere fuses.	14.1. The capacity of fuses shall be adapted as far as possible to the operating current of the lines and consuming devices which are to be protected. It shall, however, not be greater than is permissible according to the table of carrying capacities of wires and the other prescriptions of par. 20. (See the comparative chart of carrying capacities allowed in different countries.)	89a. No overheating of any part of the fuses must take place when the full current flows continuously. 89b. The fuses shall effectively interrupt the current when a short-circuit occurs, and they must be so proportioned to the current to be carried that no conductor protected by them can be raised in temperature above that specified in paragraph 37 (130 deg. Fahr. for rubber and 176 deg. Fahr. for paper and fiber. The corresponding "working currents" are given in a table forming part of the Rules). When the working current does not exceed 10 amperes (see the accompanying comparative diagram of carrying capacities in different countries) the fuses must be proportioned to interrupt the current before or when the current through the conductors rises to three times the working current; for working currents above 10 amperes the fuses must be proportioned to interrupt the circuit before or when the current through the conductors rises to twice the working current. The use of fuses of the inclosed type is recommended. No fuse smaller than one having a working capacity of 3 amperes to fuse at 9 amperes need be inserted in subcircuits.

Constant Potential—Switches

UNITED STATES	GERMANY	ENGLAND
24a. Must be placed on all service wires, either overhead or underground, in the nearest readily accessible place to the point where the wires enter the building and arranged to cut off the entire current, etc.		17. Every system not being an earthed concentric system (par. 58) must be protected by linked main switches or linked switch-fuses under the control of the consumer, and these must be easily accessible and placed as near the generator or entry of supply as circumstances permit. 22. Where energy is taken from all the conductors of a two-phase or three-phase system, the conductors must be protected, either by an automatic triple pole circuit breaker or by a fuse on each pole in conjunction with a triple-linked switch, or by three switch-fuses.

Constant Potential—Switches

UNITED STATES	GERMANY	ENGLAND
24b. Must always be placed in dry accessible places and be grouped as far as possible. * * *		78. Main and distribution switch and fuse boards must be fixed in dry situations. * * *
		23. Conductors must radiate from distributing centers and in large systems from these centers to sub-centers. * * *
Up to 250 volts and 30 amperes, approved indicating snap switches are suggested in preference to knife switches on lighting circuits. * * *	11.1. In "low-tension plants" (that is, where the voltage to earth cannot exceed normally 250 volts), the switches shall, as a rule, be snap switches.	

Low-Potential Systems, 550 Volts or Less—Wires

UNITED STATES	GERMANY	ENGLAND
26a. Where entering cabinets must be protected by approved bushings, which fit tightly the holes in the box and are well secured in place. The wires should completely fill the holes in the bushings so as to keep out the dust, tape being used to build up the wires if necessary. * * *	10d. Apparatus must be built and mounted in such a way that a sufficient state of insulation is warranted for the wires to be connected (also at the places where the wires enter) against nearby parts of the building, conductors and so forth.	
26b. Must not be laid in plaster, cement or similar finish and must never be fastened with staples.	21g. Insulated conductors may either be placed on the surface on suitable insulators or in pipes.	56. Metal staples must not be used for fixing unarmored conductors.
26c. Must not be fished for any great distance and only in places where the inspector can satisfy himself that the rules have been complied with.	21.8. Wires and cables shall, as a rule, be laid in such a manner that they can be exchanged against new ones.	
26d. Twin wires must never be used, except in conduits, or where flexible conductors are necessary.		52. Flexibles may be used under the following conditions: a. For pendent and portable appliances. b. For sub-circuits from fuse boxes * * * provided they comply with the following requirements: I. They must not be carried in positions exposed to injury or out of sight, except in conduits complying with par. 52b ii (following herewith). II. Where passing directly through division walls they must be protected by incombustible water-tight conduits. III. They must not pass through floors nor be carried unprotected within 4 feet of the floor level. IV. They must be firmly supported, and unless protected by conduits they must be attached to insulators. The supports must be spaced not more than 3 feet apart. V. They must be without joints, except in junction boxes.
26e. Must where exposed to mechanical injury be suitably protected. When crossing floor timbers in cellars, or in rooms where they might be exposed to injury, wires must be installed in approved conduit or armored cable, or be attached by their insulating supports to the under side of a wooden strip, not less than one-half inch in thickness, and not less than three inches in width. Instead of the running boards, guard strips on each side of and close to the wires will be accepted. These strips to be not less than ⅞ in. in thickness and at least as high as the insulators. Protection on side walls must extend not less than 5 ft. from the floor and must consist of substantial boxing, retaining an air space of 1 in. around the conductors closed at the top (the wires passing through bushed holes) or approved metal conduit or pipe of equivalent strength. When metal conduit or pipe is used the insulation of each wire must be reinforced by approved flexible tubing extending from the insulator next below the pipe to the one next above it unless the conduit is installed according to No. 28* (sections c and f excepted), and the wire is approved for conduit use. *Conduit installation throughout.	21a. Conductor lines in fixed position must be protected from mechanical injury by their position or by a separate protective cover; inasmuch as they are under tension against ground a separate protective cover is always required within reach of the hands, as a protection against mechanical injury. 21.1. For armored lead cables and metal covered wires and cables the metallic cover is counted as protective cover. In case of low tension (max. 250 volts to ground) pipes and conduits are classed as protective cover.	70. Conductors where exposed to injury (e.g., where passing out of floors) must be specially protected by stout conduits or boxing. 52b iii. Flexibles must not pass through floors nor be carried unprotected within 4 feet of the floor-level.
* * *

Special Rules for Open Work in Dry Places

UNITED STATES

tors, which will separate the wires from each other and from the surface wired over in accordance with the following table:

Voltage	Distance from surface	Distance between wires
0—300	½ in.	2½ in.

* * * * * * * * *

Rigid supporting requires under ordinary conditions, where wiring along flat surfaces, supports at least every 4½ ft.

If the wires are liable to be disturbed, the distance between supports must be shortened. * * *

Must not be "dead-ended" at a rosette socket or receptacle unless the last support is within 12 in. of the same.

GERMANY

in buildings (low voltage, 250 volts to ground) in open air 2 cm (¾ in.).

No regulations are made about the distance between wires, but the quasi-official commentary on the rules says that the distance between wires with knob and cleat work at low tension (250 volts), as a rule, is 5 cm (2 in.).

25.1. Wires on ordinary insulating rolls on a wall shall be supported in distances of not more than 80 cm (32 in.). If on the ceiling the distances may, in exceptional cases, be greater, according to local conditions.

ENGLAND

they must be attached to insulators. * * *

54a. Unarmored conductors must be supported in such a manner as to secure the permanent spacing of the conductors from walls, ceilings, and all structural metal work and metal piping.

b. When carrying more than 6 amperes conductors must also be spaced from each other, unless they are of the multi-core or concentric types or lead-covered.

55. Uninclosed lead-covered conductors must be supported continuously, or at intervals sufficiently frequent to prevent appreciable sagging, and must not come into contact with damp or new brickwork or plaster. The lead covering must be connected to earth.

56. Metal staples must not be used for fixing unarmored conductors.

Flexibles: 52b iv. The supports must be spaced not more than 3 feet apart.

No rules for solid wires.

For Molding Work (Wooden and Metal)

UNITED STATES

26k. Wires must have an approved rubber insulating covering and must be in continuous lengths from outlet to outlet, or from fitting to fitting, no joints or taps to be made in molding. Where branch taps are necessary in molding work approved fittings for this purpose must be used.

26l. Must never be placed in either metal or wooden molding in concealed or damp places, or where the difference of potential between any two wires in the same molding is over 300 volts.

When the electrical construction is being carried out in metal molding, permission will be given to extend these moldings through walls and partitions if the molding and capping are in continuous lengths where passing through the walls and partitions. Metal moldings must not be used for circuits requiring more than 1320 watts of energy.

GERMANY

25a. Wooden molding is not permissible. (Metal molding is not used in Germany and is practically unknown.)

ENGLAND

50. Conductors (excepting flexibles) insulated as in classes A and B (class A, rubber; class B, impregnated paper or fiber in water-proof sheath, usually of soft metal) may be inclosed in wood casing in dry places, where not buried in plaster or cement nor exposed to moisture, under the following conditions:

(a) Unless efficiently protected from drip, wood casing must not be fixed immediately below, and in no case must touch water pipes.

(b) Conductors carrying more than 6 amperes must be laid singly in separate grooves.

(c) Where the size of the conductor is larger than that of 7/19 S. W. G. (.0086 sq. in. between No. 9 and No. 10 B. & S.) sharp bends must be avoided.

Metal molding not used in England.

For Conduit Work

UNITED STATES

26n. Must have an approved rubber insulating covering and must within the conduit tubing be without splices or taps.

26o. Must not be drawn in until all mechanical work on the building has been as far as possible completed.

Conductors in vertical conduit risers must be supported within the conduit system in accordance with the following table:

No. 14 to 0 every 100 ft.

* * * * * * * * *

The following methods of supporting cables are recommended: * * *

26p. Must, for alternating systems, have the two or more wires of a circuit drawn in the same conduit.

The same circuit must not contain more than four two-wire, or three three-wire circuits of the same system, except by special permission of the Inspection Department having jurisdiction and must never contain circuits of different systems.

GERMANY

21.10. Rubber tape insulated conductors shall, even in insulating tubes, be laid only on the surface of the wall.

26d. Wire joints within the tubes are not permissible except in fixtures.

26a. Paper tubes must have a metal covering.

21h. In case of wires or cables for single or multiple-phase current which are iron-covered or protected by iron conduit, all conductors belonging to the same circuit must be contained in the same iron covering unless a dangerous heating of the iron sheath is prevented in some other way.

26c. In the same tube only conductors are allowed which belong to the same circuit.

ENGLAND

49. Conductors (excepting flexibles) insulated as in classes A and B may be inclosed in steel conduits. * * *

(Class A, vulcanized rubber, not rubber tape; class B, impregnated paper or fiber, waterproof sheath of soft metal or the like.)

25. Where protected from mechanical injury by metal conduits, conductors of opposite polarity may be bunched. Where the protecting tubing or casing is non-metallic, lengths of conductors of the same polarity and free from joints carrying small currents for incandescent lighting, from sub-centers * * * may be bunched. If the supply is alternating and the protection iron or steel, the lead and return conductors must be bunched.

For Concealed "Knob and Tube" Work

UNITED STATES

26q-26u.

GERMANY

Since frame houses are unknown in Germany, concealed "knob and tube" work is not employed.

ENGLAND

Since frame houses are unknown in England, concealed "knob and tube" work is not employed.

For Fixture Work

UNITED STATES

26v. Must not be smaller than No. 18 B. & S. gage (1624 circ. mil.) and must have an approved rubber insulating covering.

GERMANY

20.3. The smallest permissible cross-section-area for copper-conductors is for wiring on and in fixtures 0.75 mm² (=1475 circ. mil.). * * *

18a. In and on fixtures only conductors with water-tight insulation of a quality suited to the voltage applied are allowed.

ENGLAND

45. Flexibles must be of a sectional area not less than that equivalent to No. 22 S. W. G. (= 789 circ. mil.) * * *

32. Excepting for wiring fittings, the sectional area of any copper conductor must not be less than that of No. 18 S. W. G. (= 2291 circ. mil.).

For Fixture Work

UNITED STATES

In wiring certain designs of show-case fixtures, ceiling bulls-eyes and similar appliances in which the wiring is exposed to temperatures in excess of 120 deg. F. (49 deg. C.) from the heat of the lamps approved slow-burning wire may be used. All such forms of fixtures must be submitted for examination, test and approval before being introduced for use.

26w. Supply conductors, and especially the splices to fixture wires, must be kept clear of the grounded part of gas pipes, and where shells or outlet boxes are used they must be made sufficiently large to allow the fulfillment of this requirement.

26x. Must, when fixtures are wired outside, be so secured as not to be cut or abraded by the pressure of the fastenings or the motion of the fixture.

26y. Wires of different systems must never be contained in or attached to the same fixture, and under no circumstances must there be a difference of potential more than 300 volts between wires contained in or attached to the same fixtures.

GERMANY

18.3. Where the voltage to earth is greater than 250 volts joints and branches in fixtures must be avoided.

18.2. Branch joints in fixtures shall be placed as much together on one point as possible.

The Association of German Private Assurance Companies has required formerly that all fixtures be suspended by an insulating member, with exception of such fixtures as are connected to a grounded neutral; but now this is no more prescribed.

18a. cont. If the conductors are placed on the outside of the fixture they must be fixed so that they cannot shift and cannot be injured by sharp edges.

18a. cont. Where the voltage to earth is greater than 250 volts the conductors of accessible fixtures must be placed in protected positions.

18b. Where the voltage to earth is greater than 250 volts accessible fixtures are permissible only for direct current and only up to 1000 volts.

ENGLAND

(No mention is made, however, about the minimum permissible size for wiring fittings, except if it be assumed that the par. 45 quoted above refers to the minimum section permissible in fittings. The smallest section mentioned in the table of carrying capacities, which forms part of the rules, is 3/25 S. W. G. (= 1145 circ. mil.).

As regards the type of insulation permitted for fixtures, par. 52a says that flexibles may be used for pendent and portable appliances.

46. The insulating material on flexibles must be pure rubber equal to washed Para rubber of the best quality or vulcanized rubber of the best quality. Pure rubber insulation is best suited for flexibles intended for use with pendants. Pure rubber must be laid on in two layers, care being taken that the edges of each layer overlap, and the radial thickness of the dielectric must be not less than 20 mils. Each coil of pure rubber flexible must be tested in air for 15 minutes with a pressure of 1500 volts alternating between the conductors at a frequency of 50 to 100.

47. Vulcanized rubber flexible must be insulated with one layer of pure rubber and two layers of vulcanized rubber, and the radial thickness of the dielectric must not be less than 34 mils. Each coil of vulcanized rubber flexible must be tested for 15 minutes with a pressure of 1500 volts alternating at a frequency of 50 to 100 after twenty-four hours' immersion in water and while still immersed.

98. Where possible, the conductors should be carried without joints through the fittings to the lamps. * * *

99. Combined gas and electric fittings must not be used.

100. If disused gas fittings are adapted for electric light, they must be entirely disconnected from the gas pipes.

Armored Cables

UNITED STATES

27.

GERMANY

Since frame houses are not in use in Germany, armored cables are practically never employed in residence wiring.

ENGLAND

Since frame houses are not in use in England, armored cables are practically never employed in residence wiring.

Interior Conduit

UNITED STATES

28a. No conduit tube having an internal diameter of less than ⅝ in. shall be used. Measurements to be taken inside of metal conduits.

28b. Interior conduits must be continuous from outlet to outlet or to junction boxes or cabinets and the conduit must properly enter and be secured to all fittings, and the entire system must be mechanically secured in position.

In case of service connections and main runs this involves running each conduit continuously into a main cut-out cabinet or gutter surrounding the panel-board, as the case may be.

28c. Must be first installed as a complete conduit system, without the conductors.

28d. Must be equipped at every outlet with an approved outlet box or plate. At exposed ends of conduit (but not at fixture outlets) where wires pass from the

GERMANY

26.3. Conduit which is to be used for more than one wire must have an internal diameter of at least 11 mm (7/16 in.), and where the voltage is more than 250 volts to earth the internal diameter must be at least 15 mm (19/32 in.) for such conduit.

26.4. If in wiring not buried in the wall parts of the run are protected by conduit smaller diameters of the tubes are permissible.

ENGLAND

49a. Conduits must be electrically and mechanically continuous throughout. Plain slip sockets do not comply with this rule,* some form of screwed or grip joint having a conductivity equal to that of the continuous tubing being necessary.

49b. At the outlet points of switches, boxes and fittings, the ends of the conduits must either terminate at metal outlet boxes or they must socket into blocks, preferably of incombustible material. The conductors must in all cases be mechanically protected up to the fitting.

* Slip joint tubing, however, is being used very largely in England, perhaps 50 per cent of all installations being slip joint.

Interior Conduit

UNITED STATES

conduit system without splice, joint or tap, an approved fitting having separately bushed holes for each conductor is considered the equivalent of a box.

Outlet plates must not be used where it is practicable to install outlet boxes. * * * * * * *

28e. Metal conduits where they enter junction boxes, and at all other outlets, etc., must be provided with approved bushings or fastening plates fitted so as to protect wire from abrasion, except when such protection is obtained by the use of approved nipples, properly fitted in boxes or devices.

28f. Must have the metal of the conduit permanently and effectually grounded to water piping, gas piping or other suitable grounds, provided that when connections are made to gas piping they must be on the street side of the meter. * * * Where a short section of conduit * * * is used for the protection of exposed wiring on side walls * * * the conduit or pipe need not be grounded. * * *

28g. Junction boxes must always be installed in such a manner as to be accessible.

28h. All elbows or bends must be so made that the conduit will not be injured. The radius of the curve of the inner edge of any elbow not to be less than 3½ in. Must have not more than the equivalent of four quarter bends from outlet to outlet, the bends at the outlets not to be counted.

GERMANY

26.2. cont. The tubes shall further be provided with appropriate armatures, for instance, bushings so that the insulation of the conductors cannot be injured by protruding parts and sharp edges.

It is required only for voltages of more than 250 volts (to earth) that the metallic conduits be connected metallically to each other and that the conduit be grounded. (26b.)

21.8. Conductors shall, as a rule, be placed in such a manner that they can be replaced.

26.2. With metal and insulating tubes in general the internal diameters, as well as the number and the radius of the curvatures, shall be selected in such a manner that the wires can be drawn in and removed. In case of conductors of more than 16 mm² (31,568 circ. mil.) the requirement that the wires shall be withdrawable may be disregarded if the conduit is laid on the wall accessible at any time.

ENGLAND

49c. The conduits must have all free ends bushed to prevent abrasion except where wide bell-mouths are used.

49d. The conduits must be connected to earth. * * *

28. Gas-pipes must not be used to obtain an earth connection.

49d cont. In dry places isolated single lengths of tubing need not be earthed if adequately enameled, or otherwise insulated, externally.

49g. Sharp bends or elbows are prohibited, but inspection elbows are permissible.

Metal Moldings

UNITED STATES

29.

GERMANY

Since metal moldings are not used in Germany, no special rules exist for them.

ENGLAND

Since metal moldings are not used in England to any extent, no special rules exist for them.

Fixtures

UNITED STATES

30a. When supported at outlets in metal conduit, armored cable, or metal molding systems, or from gas piping or any grounded metal work, or * * * or * * * or * * * must be insulated from such supports by approved insulating joints placed as close as possible to the ceilings or walls. The insulating joint may be omitted in conduit, armored cable systems with straight electric fixtures in which the insulation of conductors is the equivalent of insulation in other parts of the system. * * *

Gas pipes must be protected above the insulating joint by approved insulating tubing, and where outlet tubes are used they must be of sufficient length to extend below the insulating joint. * * *

Where insulating joints are required, fixture canopies of metal must be thoroughly and permanently insulated. * * *

Canopy insulators must be securely fastened in place. * * *

Fixtures having so-called flat canopies, tops or backs will not be approved for installation, except where outlet boxes are used.

30b. Must, when installed out doors, be of water-tight construction.

30c. Fixtures must not when wired on the outside be used in show windows or in the immediate vicinity of especially inflammable stuff.

30d. Fixtures must be free from short circuits between conductors and from contacts between conductors and metal parts of fixtures, and must be tested for such conditions before being connected to supply conductors.

GERMANY

The Association of German Private Fire Insurance Companies required formerly that all fixtures should be grounded with exception of those which are connected to grounded neutrals; but now that is no more required.

18b. If the voltage to earth can rise above 250 volts the metal parts of fixtures must be grounded.

36a. Fixed conductors must, as far as they can come in contact with easily inflammable material, be protected entirely by tubes up to the lampholders or to the receptacles, respectively.

5. Every installation for light, power, etc., must have an appropriate state of insulation.

5.4. The state of insulation of an installation in which the voltage against earth cannot exceed 250 volts will be assumed as appropriate if the loss of current at normal operating voltage on every part between two cut-outs or behind the last cut-out does not exceed 1 milliampere. * * *

ENGLAND

99. Combined gas and electric fittings must not be used.

100. If disused gas fittings are adapted for electric light they must be entirely disconnected from the gas-pipes.

101c. Lamp-holders must not be hung from flexibles exposed to the weather.

From 122: * * * When all lamps and appliances have been removed from the circuit, the insulation resistance between conductors must not be less than 25 megohms divided by the number of lamps. * * *

Sockets

UNITED STATES

31c. Key-sockets will not be approved if installed over specially inflammable stuff. * * *

GERMANY

ENGLAND

Flexible Cord

UNITED STATES

32a. Must have an approved insulation and covering.

32b. Must not * * * be used where the difference of potential between the two wires is over 300 volts.

GERMANY

The covering and insulation of flexible cord, as well as of the other kinds of conductors, is regulated in separate prescriptions which form part of the general rules.

According to the general standard regulations for insulated conductors flexibles, if laid down in fixed positions, may be used up to 1000 volts, and if used for portable appliances, up to 500 volts.

ENGLAND

46 and 47 (quoted in full above) give prescriptions about the covering and insulation of flexible cord.

Flexible Cord

UNITED STATES

32c. Flexible cord must not be used as a support for clusters.

32d. Flexible cord must not be used except for pendants, wiring of fixtures, portable lamps or motors and portable heating apparatus.

For all portable work, including those pendants which are liable to be moved about sufficiently to come in contact with surrounding objects, flexible wires and cables, especially designed to withstand this severe service, must be used.

When necessary to prevent portable lamps from coming into contact with inflammable materials or to protect them from breakage they must be surrounded with a substantial wire-guard.

32e. Flexible cord must not be used in show windows or show cases, except when provided with an approved metal armor. * * *

32f. Flexible cord must be protected by insulating bushings where the cord enters the socket.

32g. Flexible cord must be so suspended that the entire weight of the socket and lamp will be borne by some approved method under the bushing in the socket, and above the point where the cord comes through the ceiling block or rosette, in order that the strain may be taken from the joints and binding screws.

GERMANY

18c. If the conductors are used as supports for the fixtures (pendent lamps) the connecting places (terminals) must be relieved of the mechanical stress.

(According to the standards for wires the wires for pendent lamps contain a separate carrying cord to take the tensile stress from the current-carrying wires.)

No distinction is made in the rules between ordinary flexibles and flexibles for portable work.

39. (Special Rules for Theaters) l. par. 4: The fixtures on the stage must be protected by a wire-guard for the incandescent lamps.

36. (Special Rules for Show Windows, Warehouses and Similar Localities, inasmuch as easily inflammable materials are stored in the same): * * * b. Fixtures and other appliances which can be moved about must be connected either by metal-covered conductors, or by specially protected conductors without metal sheath.

In the first case one end of the metal cover must be brought in conductive connection with the metal cover of the lamp holder, the other end must be connected to a grounded conductor.

In the second case only flexible cord with watertight insulating cover is permitted, which is provided with a cover of tough material (such as canvas, leather, hempen cord braiding, etc.) as a protection against mechanical injury.

18c. If the conductors are used as supports for the fixtures (pendent lamps) the connecting places (terminals) must be relieved of the mechanical stress.

(According to the standards for wires, the wires for pendent lamps contain a separate carrying cord to take the tensile stress from the current-carrying wires.)

ENGLAND

52. Flexibles may be used under the following conditions:

a. For pendent and portable appliances. * * * * * * * * * * * * *

52. Flexibles may be used under the following conditions:

* * * * * * * * * * * * *

b. For subcircuits from fuse boxes * * * provided they comply with the following requirements:

I. They must not be carried in positions exposed to injury or out of sight, except in conduits.

II. Where passing directly through division walls they must be protected by incombustible watertight conduits.

III. They must not pass through floors nor be carried unprotected within 4 feet of the floor level.

IV. They must be firmly supported, and unless protected by conduits they must be attached to insulators.

V. They must be without joints except in junction boxes.

105a. Incandescent lamps must not be placed in close proximity to combustible materials unless specially protected. * * *

105b. Incandescent lamps must be fitted with guards if placed in positions where goods are liable to be in contact with them.

96c. The terminals of ceiling roses must be relieved of the direct pull of the attached conductor and fitting, and be so arranged that no short-circuit can take place.

COMPARATIVE TABLE ON REQUIREMENTS OF INSULATION RESISTANCE IN ORDINARY DRY INDOORS INSTALLATIONS (IN OHMS)

(Resistances to be measured beginning from and after distributing board)

	United States	Germany	England	Austria	Italy	Switzerland	Sweden	Russia
Paragraph of the regulations	88	5	121, 122	104	16	136	14	4
Voltage at which measurements of insulation resistance must be made		If possible, with operating pressure, at least with 100 volts.	Pressure not less than the intended working pressure.	If possible, with operating pressure, at least with 100 volts.		Direct current of at least 100 volts.	Operating voltage; if not possible, at least 50 volts.	
Formula. I = max. (effectual) current, E = max. (effectual) voltage, N = number of lamps, n = number of lamp outlets (not counting wall-switch outlets).	I = 5 amp, $< \frac{4{,}000{,}000}{E}$ 10 amp, $\frac{2{,}000{,}000}{E}$ 25 amp, $\frac{800{,}000}{E}$ etc. If fixtures are connected, one-half of the above values.	$R = 1000\ E$ between any two fuses or in the run after the last fuse.	$R = \frac{30{,}000{,}000}{n}$ to earth previously to erection of fixtures. $R = \frac{25{,}000{,}000}{n}$ between conductors with fixtures in place.	$R = 5000\ E/I$ in $>$ every branch and besides $R = > 1000\ E$ in every branch.	$R = 1000\ E$ between any two fuses or in the run after the last fuse.	$R = 1000\ E$ between any two fuses or in the run after the last fuse.	$\frac{1{,}000{,}000}{N}$ and besides for every main branch: $10{,}000 + \frac{1{,}000{,}000}{N}$	No definite figures
Insulation to be measured to ground or between wires	Both	To ground; but regulations are made in case insulation between conductors is measured also.	Both. See above.	Both	Both.	Both.	To ground.	
Lamp sockets, electroliers, etc., connected or not	See above.	When measuring between conductors fixtures must be connected.	See above.	When measuring between conductors fixtures must be connected.	When measuring between conductors fixtures must be connected.	When measuring between conductors fixtures must be connected.	Not stated.	

(See next page)

COMPARATIVE TABLE ON REQUIREMENTS OF INSULATION RESISTANCE IN DRY INDOORS INSTALLATIONS (IN OHMS)—EXAMPLES, 110 VOLTS
(Insulation resistances after the last fuses, in ohms)

Number of			United States	Germany	England	Austria	Italy	Switzerland	Sweden	Russia
40-Watt Lamps *N*	Lamp Outlets *n*	Circuits								
5	5	1	*a*) 4,000,000 *b*) 2,000,000	110,000	*c*) 6,000,000 *d*) 5,000,000	302,000	110,000	110,000	200,000	No definite figures
10	8	1	*a*) 4,000,000 *b*) 2,000,000	110,000	*c*) 3,750,000 *d*) 3,125,000	151,000	110,000	110,000	100,000	No definite figures
20	15	2	*a*) 2,000,000 *b*) 1,000,000	55,000	*c*) 2,000,000 *d*) 1,667,000	75,500	55,000	55,000	50,000	No definite figures
30	25	2	*a*) 800,000 *b*) 400,000	55,000	*c*) 1,200,000 *d*) 1,000,000	55,000	55,000	55,000	33,300	No definite figures
30	25	3	*a*) 800,000 *b*) 400,000	36,700	*c*) 1,200,000 *d*) 1,000,000	36,700	36,700	36,700	33,300	No definite figures
60	48	8	*a*) 800,000 *b*) 400,000	13,750	*c*) 625,000 *d*) 521,000	25,200	13,750	13,750	16,670	No definite figures

a) With fixtures disconnected. *b*) With fixtures connected. *c*) To earth, previously to erection of fixtures. *d*) Between conductors with fixtures in place.

Engineers' Report on Water-Power Extensions for Sanitary District of Chicago

The commission on sewage disposal and water-power development appointed by the Sanitary District of Chicago to investigate plans for the utilization of the 10,000 to 14,000 second-feet of water which will be available at the completion of the Chicago River improvements and channel extensions now contemplated submitted its water-power report to the trustees of the District on Nov. 12. Mr. Lyman E. Cooley, Chicago, is chairman of the committee, the other members of which are Messrs. John Ericson, William Artingstall and H. H. Walker.

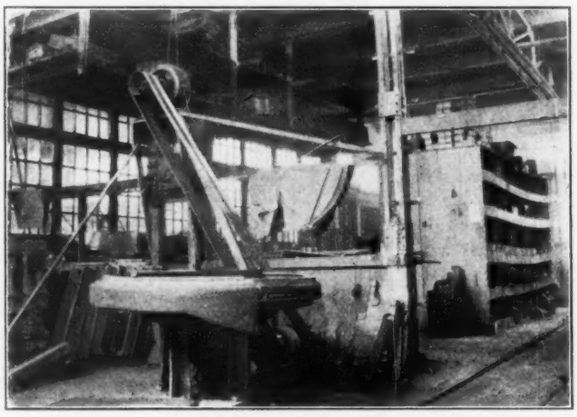
According to the report, the city of Chicago now absorbs for street-lighting and other municipal purposes 53 per cent of the total electrical output of the Sanitary District but pays only 27.5 per cent of the District's total earnings. Commercial customers, on the other hand, receive 26 per cent of the output and furnish 55 per cent of the revenues. The average rate paid by the city is estimated at 5.9 mills per kw-hr., including the substation charge of $1 per lamp.

The irregularities of flow in the canal may be compensated for and the need of the proposed steam plants avoided, the commission declares, by discarding the present commercial lighting load, increasing the daytime and twenty-four-hour loads, and shifting the working day to avoid overlapping of day and night loads during the winter months. Furthermore, it is proposed to increase the available rating of the power plant at Lockport by (1) equalizing the load demand, (2) increasing the head by enlarging the channel below the plant and extending the Joliet level, (3) increasing the efficiency by modernizing the installation at the present plant, and (4) increasing the volume of water up to the legal rate of dilution. In this way it is expected to increase the electrical output not only proportionally to the increased volume of water, but also by reason of an increase of 20 per cent in efficiency through modernizing the plant and improving the discharge channel. The commission also recommends that the operation, maintenance and contract divisions of the Sanitary District organization be segregated under a distinct head, that the accounting system be revised, and that the administrative organization be reduced and its efficiency increased.

The present rate of return is declared to be inadequate to the investment, and in view of the relatively small revenue received for the city-lighting energy the commission recommends that a system of "reasonable rates" be established, based on the relative cost of furnishing service to each class of customers. This is taken to mean, of course, that an increase would be demanded over the rate at which energy is now sold to the city—estimated as equivalent to 5.5 mills to 5.9 mills per kw-hr. It is also intimated in the report that the District's distribution lines and equipment should be ultimately disposed of, and that the function of the District be restricted to the delivery of energy to some central receiving point for each municipality served.

Gasoline-Engine Factory Uses Central-Station Service

The Witte Iron Works, a Kansas City (Mo.) firm making gas and gasoline engines in many sizes, is gradually rearranging its plant so that all machines will be operated by motors driven from the lines of the Kansas City Electric Light Company. Formerly two large gas engines were used to drive the factory machines, but now one of these has been taken out and it is expected that the other will soon follow. The illustration herewith shows one of the factory's interesting applications of electricity. The small motor mounted overhead drives a circular sanding table upon which the bases of small engines are ground to level surfaces. The sanding circle is partitioned so that several small engine bases may be sanded simultaneously.



MOTOR-DRIVEN SANDING TABLE IN GASOLINE-ENGINE FACTORY USING CENTRAL-STATION SERVICE

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Co-operative Newspaper Advertising

By promptly informing residents of St. Louis, Mo., of a large reduction in the price of the vacuum cleaners which it handles the Union Electric Light & Power Company last month produced a notable increase in its sales. A copy of the announcement made jointly by this company and the Sanitary Sales & Service Company is

ANNOUNCEMENT!
Owing to the Enormous Increase in Sales of
The EUREKA
Electric Vacuum Cleaner
The Following Reduction in Prices Is Announced.
Old Price, $40.00, Now $31.00
COMPLETE WITH ALL ATTACHMENTS,
Old Price, $49.00, Now $36.00
Less 5% for Cash, or on Liberal Divided Payment Terms.
ASK FOR FREE DEMONSTRATION.
SANITARY SALES AND SERVICE CO.
1214 Olive Street.
UNION ELECTRIC LIGHT and POWER CO.
12th and Locust Sts. 3012 S. Grand Av.
4912 Delmar 3028 N. Grand Av.

A TWO-COMPANY ADVERTISEMENT

shown herewith. Twenty-two and a half per cent reduction was offered on the vacuum cleaners alone, while 26.5 per cent was allowed with all attachments. Besides these reductions, the electric-service company offered liberal instalment terms or a 5 per cent discount for cash payments. Free demonstrations were given by the Sanitary Sales & Service Company. While the cleaner affected by the reduction in price is a staple product with the Union Electric Light & Power Company, Mr. C. E. Michel, manager of the appliance department, says that the newspaper advertisements were productive of very satisfactory results.

The Electric Vehicle and the Middle of the Road

The prejudice which exists in the minds of some drivers of gasoline cars against electric vehicles is heightened, perhaps, by the insistence with which the operators of many electric cars keep to the middle of the roadway or boulevard, thus getting in the way of the gas-car owners who prefer to travel at speeds approaching the ordinance limits. This charge of driving in the middle of the road has been laid principally against women users of "electrics." Some of the offenders offer the defence that the salesmen or demonstrators from whom they purchased their cars advised them to drive on the central crown of the pavement in order to avoid spilling the acid from the battery jars. This explanation has, of course, as little justification as the practice of monopolizing the middle of the road. In cities where traffic is dense offending drivers of electric cars may do the electric-vehicle cause an injury, for each gas-car driver they thus annoy is a potential purchaser of an "electric" if the superior advantages of this silent, clean and dependable form of locomotion could be demonstrated to him when in a receptive frame of mind.

Promoting Among the Real Estate Promoters

Almost every central-station company has had experience with the real-estate promoter who, succeeding in selling a few houses in his pet addition, comes to the contract office and demands that his patrons be supplied immediately with electric service. It seldom makes any difference to the promoter how far the electric company must extend its mains to reach the new houses. What he wants is immediate service. If the electric company cannot profitably make the extension, the notoriety it is likely to receive at the hands of an unscrupulous promoter is not desirable.

To avoid such difficulties Mr. S. R. Gallagher, new-business manager of the Springfield (Mo.) Gas & Electric Company, recently attempted a new method of procedure with notable success. Three real-estate companies had united to promote the sale of land in a new addition, beautifying the area by paving driveways in a park and building an artificial lake. The site of the improvements was well outside the district served by the electric company. Before the lots had been laid off and before prices had been established Mr. Gallagher met the real-estate men and told them how much easier it would be to sell lots if electric lines were already in the alleys waiting to be connected to customers' houses. Many other of the myriad advantages to be derived from electric service were also pointed out. There

RESIDENCE WITH CONNECTED LOAD OF 3 KW

were no gas mains in the addition, and that point, too, was emphasized.

The real-estate men understood, of course, that it was preposterous to expect the electric company to build lines into empty fields, but they also saw, when it was pointed out, that if the lines were built with real-estate funds the cost could easily be apportioned and added to the price of the lots. The talking point—

"electric service furnished"—was worth the investment. Accordingly thirty-three spans of distribution line were built, and the three real-estate companies paid $675 for the construction and material. The electric company now owns this line of 35-ft. cedar poles, and the copper wire it supports is heavy enough to carry all future residence load.

Entire satisfaction has resulted from the arrangement, and a few customers are beginning to be added along the pole line. Good salesmanship exercised in the new district has secured a 3-kw connected load in one house alone. Cooking, water heating and all domestic operations are performed electrically. The water heater placed in the cellar is connected for economy through a four-way switch so that energy can be turned on or off in the cellar, kitchen or both.

FIG. 2—BUNGALOW 11 MILES FROM CENTRAL STATION SUPPLYING IT WITH ENERGY

Meter Practice on Rural Electric-Service Lines

On the country lines of the Noblesville (Ind.) Heat, Light & Power Company, which radiate in many directions from the company's central station, all customers' meters are placed out of doors unless local conditions make such practice entirely inadvisable. Generally the meters are hung on the side of the customer's house or barn under the shelter of a porch roof or overhanging canopy. No attempt is made to surround the meters with boxes or cases of any sort, since the central-station men believe that if the meters are protected from the driving rain by overhanging roofs they will perform their functions accurately without further protection. With this practice carried out consistently a meter reader does not have to make a second call if the customer is not at home the first time. If, on the other hand, the customer is at home, the meter can be read quickly and time taken to ask questions about service and to remedy complaints. A lineman is generally selected for reading meters, for he can attend to complaints while he is making his periodical trips over the lines. A reading of each customer's meter is taken quarterly, and the meter reader never fails to acquaint himself with conditions at each farm and to suggest the use of motors or other electrical appliances where they will save time and money for the patron.

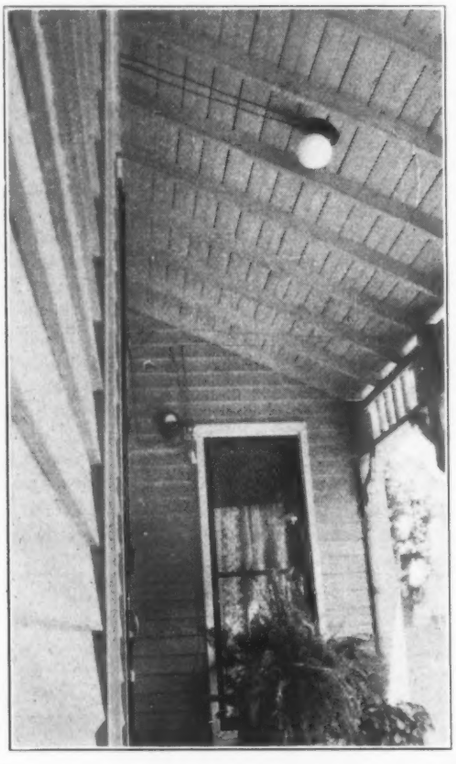


FIG. 1—TYPICAL METER INSTALLATION; INSIDE WIRING CONCEALED

The meterman's conveyance while on these trips is a veritable electrical storehouse. In it there is always a full stock of fuses and lamps. They are the staple commodities of the electrical business. In addition to these necessities the meterman carries on each trip a single feature article to be demonstrated to customers. On one trip the meter reader will carry a stock of flatirons; the next time he will have vacuum cleaners or perhaps toaster stoves. These wares are exhibited and placed in operation in the farmers' homes. Sometimes the devices are left on trial and the sales results obtained from this practice are indeed gratifying.

Wichita Company's Booth at Dry Farming Exposition

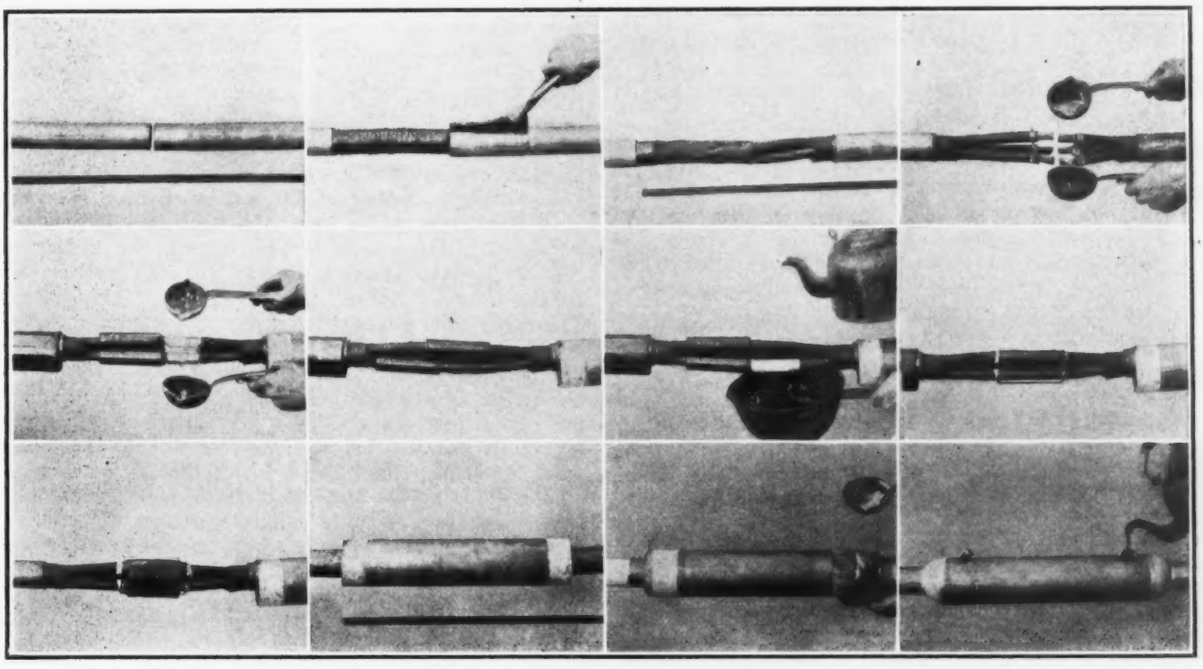
At the fourth annual fall exposition and International Dry Farming Congress held at Wichita, Kan., the Kansas Gas & Electric Company exhibited a model dining-room, a kitchen and a laundry electrically equipped. Women demonstrators explained prices and operating costs to interested visitors. To further exploit the use of electricity the electric company secured several rolls of motion-picture films showing applications of electric power in the home and on the farm, and these pictures were shown twice a day free of charge.

PART OF CENTRAL-STATION BOOTH

Illumination and Wiring

Cable Jointing

The kind of cable used for underground circuits will have little effect on the reliability and stability of a system if the joints are made improperly. Excessive heating may occur at the joints if their conductivity is not so high as that of a continuous section of the cable. Furthermore, if the insulation between conductors and the lead sheath is not restored to its original dielectric and resistance value, a break-down may occur when the cable is energized. At the Pittsburgh Crucible Steel Company's plant, Midvale, Pa., where underground circuits are relied upon entirely for supplying energy, tube joints are employed. With this method of jointing it is declared that one man and two helpers were able to make an average of six splices in a three-conductor No. 1 cable in one day. The successive operations required in completing a joint are shown in the illustration.



SUCCESSIVE OPERATIONS IN SPLICING CABLE

For splicing the chief requisites were three split copper tubes or connectors, three paper tubes to be slipped over each conductor, one large tube to be placed over the three smaller ones, one lead sleeve, and the usual tape and tools. After shaping the cables around the manhole their ends, which had previously been covered with solder to exclude moisture, were sawed off, leaving them just touching each other. Then the lead sheath was stripped off one cable for 9.5 in. and off the other for 5.5 in. Eight and one-half inches and 4.5 in. of the outer cambric belt were removed from the cable ends respectively, leaving one inch of the covering projecting beyond the sheath on each cable.

Over the shorter stripped cable was next slipped the lead sleeve, one end of which had been dressed down to fit the sheath. The cambric insulation on each conductor was then removed for 2.25 in. back from the ends, the copper thoroughly cleaned and the conductors arranged with two in a horizontal plane on top and the third centered beneath them. After tinning the conductors the large paper tube was slipped over the cable sheath on the longer stripped end, followed by the conductor tubing.

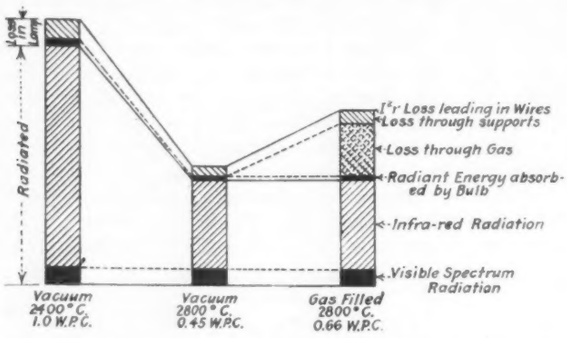
The copper sleeves were put on the conductors with their ends just touching and sweated on, using two ladles as indicated in the views published herewith. Before the solder had set the connectors were wiped smooth and two layers of cotton tape wrapped over the joint, taking care that none overlapped the cambric insulation. The tape was thoroughly impregnated with joint compound and the small paper tubes were slipped over the joint, centered and tied in place. After the larger paper tube had been similarly fastened over the conductor tubes the lead sleeve was slipped over them all and its ends dressed down to the size of the cable sheath and fastened thereto with a wiped joint. Two V-shaped openings were made in the top of the sleeve, one at each end, and into these was poured "ozite" until the case was full. The insulating compound was poured at a temperature of 450 deg. Fahr. and allowed to boil out about thirty minutes. As it settled into the crevices and interstices more compound was added slowly until the joint was full and cold. The openings were then soldered up, making the joint complete. No soldering pastes or acids were used in making the joints for fear of starting corrosion.

Phenomena of the Nitrogen-Filled Lamp

Among the interesting experiments performed by Mr. S. E. Doane, Cleveland, Ohio, before the joint meeting of the Chicago engineering societies, Nov. 25, was one arranged to show that the so-called "stationary" film of gas about the filament of the nitrogen-filled lamp really clings to the filament and moves upward along it. A gas-filled lamp with long, straight vertical filaments was first operated for a short time in an upright position. The lamp was then quickly inverted and at once the reversing convection waves could be distinctly seen as each traveled up its respective filament, the advancing wave-fronts being made visible by their refractive action on the light from the glowing filaments.

An instructive diagram shown by Mr. Doane is reproduced herewith and illustrates three lamps which have energy consumptions respectively of 1 watt per candle for

the filament in vacuum at 2400 deg. C.; 0.45 watt per candle for the filament in vacuum at 2800 deg. C., and 0.66 watt per candle for the filament at 2600 deg. C. in the gas-filledl amps assumed for comparison. The upright column at the left shows how energy is dissipated in an ordinary vacuum tungsten lamp, while the middle column shows what the efficiency of an ordinary vacuum



ANALYSIS OF POWER CONSUMED IN TUNGSTEN-FILAMENT LAMPS ON THE BASIS OF EQUAL LUMINOUS OUTPUT

tungsten lamp would be if operated for a short-lived period at the temperature of the gas-filled lamp. The analysis of the energy consumption in the gas-filled lamp, illustrated at the right of the sketch, shows how an efficiency of 0.66 watt per candle is attained in lamps of commercial length of life, by allowing convection losses to occur through the gas.

Letters to the Editors

The Cheap Electric Vehicle

To the Editors of the Electrical World:

SIRS:—Referring to the ever-present discussion as to the advisability of marketing a cheap electric automobile, it seems to the undersigned that the demand for only the most refined and luxurious electric vehicles is attributable to the fact that the electric car is supposed by the general public to be much more expensive to operate than the gasoline car, because the gasoline expense is less than that for electricity. The result has been that any man who is willing to pay a higher operating cost for the increased comfort and convenience of the electric vehicle is able and willing to buy the most comfortable machine built.

By convincing the majority of moderately well-to-do persons that the electric vehicle is cheaper to operate than the gasoline car, there can be created a great demand for the car which is also cheaper in first cost; then the low-priced electric vehicle will come into its day.

Lake Charles, La. F. V. GALLAUGHER.

Meaning of Alternating-Current Ammeter Readings

To the Editors of the Electrical World:

SIRS:—Everyone who has begun to think of matters relating to the electrical distribution of energy knows that we have direct-current distribution and alternating-current distribution, and nearly every one knows that a direct current of 10 amp is simply an actual steady current of just 10 amp flowing always in the same direction in a wire. On the other hand, an alternating current flows in one direction and then in the other direction through a circuit, the reversals of direction taking place, say, 120 times per second; and the beginner is always puzzled to know exactly what is meant when it is stated that "an alternating current of 10 amp" flows through a circuit! The simplest, and indeed the only, answer to this question is obtained by considering how alternating current is measured. The type of ammeter which must be used for the accurate measurement of an alternating current is an instrument in which the movement of the pointer is proportional to the square of the current flowing through the instrument; that is to say, to reverse the current does not reverse the deflection of the pointer and if the current is doubled the pointer will move four times as far from the starting point. This fact is visualized in Fig. 1. The distance d moved by the pointer is proportional to the square of the current through the instrument. If the current slowly rises and falls in value, the pointer, of course, moves back and forth, but if the current pulsates very rapidly in value then the pointer takes up a steady position such that the steady value of d is proportional to the average value of the square of the current; that is to say, an alternating-current ammeter indicates, strictly, the average value of the square of the alternating current which flows through it. This matter may be made more intelligible by considering the practical meaning of the average value of the square of an alternating current. If a current flows through a wire, the heating effect is proportional to the square of the current, and if the current varies the average heating effect is proportional to the average value of the square of the current. Therefore the alternating-current ammeter measures what may be called the heating value of the alternating current.

The statement that an alternating-current ammeter measures the average value of the square of the current is exactly correct, but the scale on the instrument is what is called a square-root scale; that is, mark No. 2 on the scale is four units of distance from A in Fig. 2, mark No. 3 is nine units of distance from A, mark No. 4 is sixteen units of distance from A, and so on. Therefore the reading r of the pointer is proportional to the square root of d, and an alternating-current ammeter provided with this kind of a scale indicates the square root of the average value of the square of the current.

This communication has been prompted by a "question-box" discussion which took place at the meeting of the Allentown Branch of the National Electric Light Association on the evening of Oct. 6. Nearly everybody in attempting to discuss this matter gets lost in the consideration of the "sine wave," which, of course, is a mere abstraction. I have always been in the habit of developing the argument as to the meaning of the reading of an alternating-current ammeter by considering the things and actions which take place inside of

FIG. 1—UNIFORM SCALE

FIG. 2—SCALE OF SQUARE ROOTS

an instrument, but the difficulty of presenting the argument on this basis is that very few electrical workmen have seen the inside of an instrument. The fact of the matter is, however, that the only thing that is necessary is to look at the pointer and consider what is stated above in regard thereto.

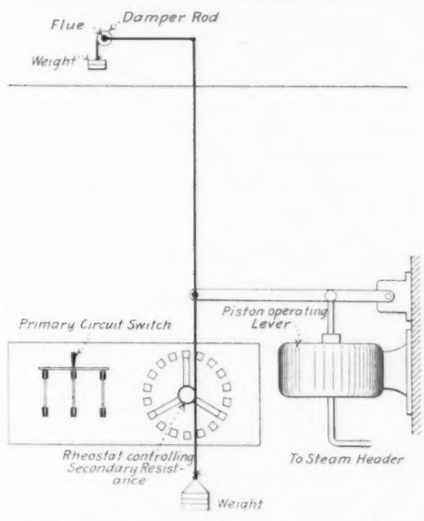
South Bethlehem, Pa. W. S. FRANKLIN.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Automatic Regulator for Stoker and Damper

In the generating station at Owensboro, Ky., is an automatic device which regulates the speed of the furnace stokers and opening of the flue dampers to give constant steam pressure. The apparatus consists of a piston-operated lever which rises or falls with variations in steam pressure, causing the damper to operate



APPARATUS REGULATING DAMPER OPENING AND STOKER SPEED

in the proper relation with the stokers, which are motor-driven. As wound-rotor motors are employed, their speed has to be controlled by varying the secondary resistance. When this apparatus was being developed it was found that the speed regulation obtained with a certain change in secondary resistance varied with different loads. It is therefore necessary to operate each motor controlled from this device at practically uniform load. The accompanying illustration shows how the piston-operated lever is connected with the damper and rheostat shaft. The wire cord operating the rheostat is wound around its axis several times and the loose end weighted so that movement of the lever will cause rotation of the rheostat shaft. A three-blade knife switch is also mounted on the regulating panel to control the primary circuit.

The Classification and Sale of Scrap Material

Mr. B. I. Budd, president Chicago Elevated Railways, in a talk before the recent meeting of the Illinois Electric Railways Association, of which he is president, referred to the work of the scrap experts and engineers who are now engaged in campaigns among electric-lighting and railway companies for the more advantageous disposal of scrap and refuse material. Analyses of the usual methods of the collection and sale of scrap, said Mr. Budd, show that this material, extremely valuable in the aggregate, has been handled loosely and sold loosely in most organizations, while owing to the incompleteness of the classification given the scrap the prices received fall far short of those which should be earned. During present business conditions President Budd urged on the part of company executives a closer attention to the disposal of scrap material.

Disciplining the Man to Blame for the Accident

At the meeting of the Illinois Electric Railways Association at Chicago, Nov. 21, Mr. W. F. Carr, Ottawa, Ill., advised against the policy of discharging men who have made mistakes which caused accidents, for, he declared, a serious accident for which a man is to blame leaves an indelible impression upon his mind and makes him a more careful and thoughtful operative in the future. If, on the other hand, this same man were to be discharged, his place must be given to a new man, and it is very possible that the whole lesson of safety and carefulness will then have to be learned all over again.

Tunnel Cable Crossing Under the Milwaukee River

To provide connections for electric cables and steam-service mains between the east and west sides of the river in the downtown district of Milwaukee the Milwaukee Electric Railway & Light Company has built a tunnel at Oneida Street. The tunnel supplements two existing crossings. Before starting the work three types of crossings were considered for this location.

BUILDING TUNNEL FOR ELECTRIC CABLES

These were submarine cables, steel end shafts lined with concrete and connected by a cast-iron pipe tunnel, and a driven tunnel constructed under air pressure and fitted with iron or concrete lining. The first type of construction was considered unsatisfactory, as it made no provision for steam pipes and it exposed the cables to mechanical injuries. The second class of construc-

tion, it was decided, presented advantages over the third type because of its lower first cost and the greater speed with which it could be constructed.

The river crossing as it stands completed is 216.7 ft. in length, the horizontal cast-iron pipe tunnel lying 41 ft. below the surface of the earth. There will be ample space in the shafts and tunnel for the passage of a man after eighty conduits and two steam mains have been placed against the walls.

Using a Cold Machine on the Peak of the Load

One of the operating rules in the transforming and generating station of the Springfield (Mo.) Gas & Electric Company requires that the sixty-cycle load be transferred from one to the other of the company's two 1000-kw frequency changers at the time of day just preceding the peak. In this way a frequency changer with cold windings is provided at a time when maximum output is demanded, the two similar 1000-kw machines being used alternately for twenty-four hour runs. The main advantage to be derived from the operation of a machine with cold windings, it is explained, lies in the possibility of using reduced field current. At Springfield it has been found possible to carry the loads with reduced current in the field coils when a machine is cold, even though the bus voltage is carried slightly above normal during the peak. Energy for driving the frequency changers is secured from the transmission lines of the Ozark Power & Water Company.

Utilizing a Traction Engine During Plant Repairs at Maryville, Mo.

During the last summer it became necessary for the Maryville (Mo.) Electric Light & Power Company to send one of its reciprocating steam engines to St. Louis for repairs. The story of how the load was handled in the meantime is told in the following words in a recent letter from Mr. C. C. Hellmers, secretary and manager of the company:

"In addition to the disabled unit, we had another engine with a 125-kw generator, which could handle the

TRACTION ENGINE DRIVING 75-KW ALTERNATOR

load except on Saturday night. We knew, however, that it would be necessary to do a little tightening up from time to time and so did not want to risk carrying the load with one engine.

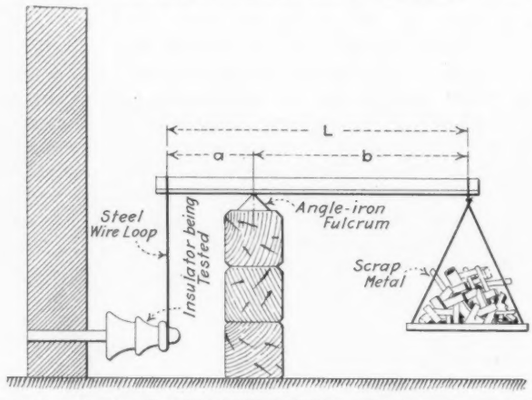
"In the station was an extra 75-kw generator, and this we hooked to a large traction engine, and by this method we were able to keep up our twenty-four-hour service without interruption. The traction engine was operated singly from midnight until morning and on Sundays, when our load was lightest, and we also used it in connection with our other engine at night when the load was heavy.

"Our disabled engine was away for six weeks, but we were able to operate satisfactorily without interruption. We did the work during July when our load is lightest and we might have been able to get along with the one engine by shutting down on Sunday afternoons. But we have always said that twenty-four-hour service means continuous service; therefore, we used the traction engine to tide us over the period of stress."

Apparatus for Testing Approximate Breaking Strength of Pin Insulators

Will you describe some home-made apparatus for testing the approximate breaking strength of pin-type insulators? We prefer having a description of equipment which can be readily assembled from materials found in any locality. E. T. L.

Whenever it is necessary to determine the breaking strength of assembled pin insulators where delicate testing apparatus is not available the equipment illustrated herewith may be employed to obtain approximate results. The pin may be inserted in a hole in a stout vertical timber as shown and a strong steel wire looped over the insulator head and fastened to one end of a rigid steel bar supported on the edge of an angle iron and weighted at the other end. If only scrap material is available for weighting the lever, it can be supported on a platform suspended from the end of the bar. The angle iron or fulcrum on which the lever rests can be laid on any substantial support such as a heavy wooden block. After the lever has been supported for the test, the lengths of the lever arms should be measured, then the pan should be loaded until the insulator fails. The material used in loading the lever, together with the platform employed to support it, should then be weighed on a platform scale and the value thereof multiplied by the lever ratio. If the weight of the lever is considerable, a correction may be made by adding to the breaking strength as computed above $\frac{W}{2La}(b^2 - a^2)$, where W is the weight of the bar in pounds, L is the



APPARATUS FOR TESTING BREAKING STRENGTH OF INSULATORS

total length in inches, a is the length of the lever arm attached to the insulator, and b is the length of the lever arm supporting the weights expressed in inches. This correction is unnecessary if the fulcrum is placed close to the middle of the lever, but may become a considerable part of the breaking strength if a large lever ratio is employed.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Standardization Rules.—An editorial discussion of the revised standardization rules of the American Institute of Electrical Engineers. Heating tests are especially discussed and reference is made to the suggestion of the employment of thermocouples or resistance coils placed as nearly as possible at the estimated hottest spot of a machine. "We doubt whether the general introduction of these 'hot-spot' temperature measurements is altogether desirable. We admit that a method of this kind will give very useful information to the manufacturer, and it will probably be worth while to apply it to any new line of machines; but once the manufacturer has gained his experience it seems to us that the older methods give all the information that is necessary for testing a plant and seeing that it complies with the guarantees."—London *Electrician*, Nov. 13, 1914.

Lamps and Lighting

Street Lighting with Nitrogen-Filled Tungsten Lamps.—L. BLOCH.—A paper read before the Association of German Central Stations on June 19, 1914. The author points out the great advance of the nitrogen-filled tungsten lamp consuming 0.5 watt per cp over the old drawn tungsten-filament lamp consuming 0.8 watt or 1 watt per cp. The nitrogen-filled lamps are rated in Germany exactly like arc lamps, according to the hemispherical candle-power with a clear-glass globe and without an external reflector. While the nitrogen-filled tungsten lamps were made in the beginning only in sizes from 1000 cp to 3000 cp for standard voltages, they are now available for 110 volts in sizes down to 200 cp and for 220 volts in sizes down to 400 cp. In the accompanying table the different types of nitrogen-filled lamps are given, as used for lighting different kinds of streets

DATA ON NITROGEN-FILLED LAMPS

	Mean Horizontal Illumination in Meter-candles	Candle-power of Nitrogen-Filled Tungsten Lamps	Height of Lamp Above Ground, Meters	Distance Between Lamps in Direction of Street, Meters
Big white ways in large cities	10.0 to 20	2000 to 3000	7.0 to 9.0	25 to 45
Main streets	5.0 to 10	600 to 2000	5.0 to 8.0	30 to 60
Side streets with considerable traffic	2.5 to 5	200 to 600	4.5 to 6.0	30 to 80
Side streets with little traffic	0.5 to 2	50 to 200	3.5 to 5.5	30 to 80

in Germany. The mean horizontal illumination in meter-candles is measured at a height of 1 m above the ground. It will be seen from the table that German streets are now better lighted than they were ten years ago. The author gives the photometric curves of the distribution of light from various types of nitrogen-filled tungsten lamps and shows by different numerical examples the distribution of light in a street and how high a degree of uniformity of illumination can be obtained in street lighting. The paper is to be concluded. —*Elek. u. Masch.* (Vienna), Oct. 18, 1914.

Installations, Systems and Appliances

Large Electric Kitchen.—KURT PERLEWITZ.—A fully illustrated description, based on a recent paper by A. Steinhard, of the electric kitchen in the new office building of the Siemens-Schuckert company near Berlin, with an equipment for feeding daily 3000 persons in four groups each of from 700 to 800 people. Since the generating equipment for lighting the office building is used only in the afternoon hours of the winter months,

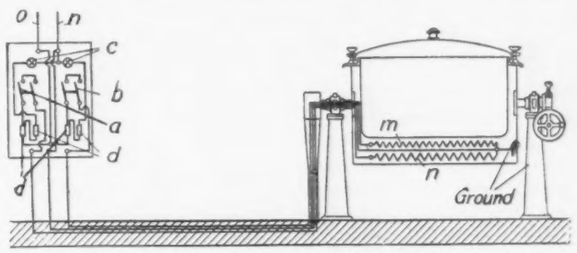


FIG. 1—WIRING ARRANGEMENTS FOR HEATING VESSEL

energy is available at a low rate at other hours. The electrical equipment of the kitchen consists of four roasting ovens, eighteen roasting pans, eleven heating vessels and two heating closets. All apparatus is for 220 volts distributed equally between the two halves of the three-wire network. The earthed neutral is connected without a fuse to one pole of the heating elements, and at the same time connection is made with the metallic body of the apparatus. The outer circuits contain a fuse and the switch for temperature regulation. The roasting pans ($400 \times 600 \times 65$ mm) are of wrought iron, the heating elements being placed below the bottoms of the pans and pressed against them by means of a plate. The heating element of a roasting pan which can roast 200 chops an hour has a rating of 7 kw. The heating vessels have two sets of heating elements directly within the bottom, so that by tilting the vessel the heating elements can be easily taken out and replaced when necessary. These vessels are used for cooking meat, vegetables, soups, etc. For preparing dishes with the addition of milk, for cooking cabbage, etc., direct heating by means of heating elements in the bottom of the vessel is employed. For such purposes some of the vessels have oil jackets and the heating elements are outside of the oil jacket and below the bottom of the vessel. When filled, these vessels have an efficiency of 82 per cent during the heating period against 90 per cent for vessels with direct electric heating. But this difference is unimportant since the oil jacket represents a very economical storage of heat. When the energy supply is cut off the contents of the vessel continue to boil for one and one-half hours. The circuit connections for such a heating vessel are shown in Fig. 1, in which *o* is the outer conductor and *n* the neutral wire of the network, *a* and *b* are the main switches for the principal circuit and the auxiliary circuit respectively, *c* lamps, *d* fuses. The heating vessel is shown on the right, with two sets of heating elements in the bottom *m* and *n*. Both sets of heating elements are distributed all over the bottom of the vessel

and divided up into branch circuits. Vessels to contain 400 liters have two circuits of 12 kw and 24 kw respectively, so that 12 kw, 24 kw or 36 kw can be supplied to the vessel. Vessels for 200 liters consume a maximum of 18 kw. The coffee machines for preparing 75 and 150 liters per hour respectively have a rating of 12 kw and 18 kw. The mean average energy consumption per day for each person in the office building is 0.430 kw-hr., of which 0.312 kw-hr. is for cooking alone. Load curves are given showing that the energy consumption is lowest on Saturday because many of the employees do not take their lunch there. The energy consumption per person is correspondingly a maximum on Saturday. Since the energy for kitchen purposes is charged at 1.25 cents per kw-hr., the total energy cost per person a day is 0.54 cent. The total yearly energy cost of from $2,500 to $3,000 can probably be decreased by 10 per cent after the attendants have become familiar with the most economical way of handling the apparatus. Since the total expense of the kitchen is from $125,000 to $150,000 a year, the energy cost is only 2.5 per cent of the total cost. The figures for two other electric kitchens are as follows: In the electric kitchen of the Cable Works of the Siemens-Schuckert company the total energy cost per person is 0.97 cent (170 persons, rate of charge 2.5 cents per kw-hr.), and in the electric kitchen of the Hennigsdorf factory of the Allgemeine Elektricitäts Gesellschaft the corresponding figure is 0.51 cent (130 persons, rate of charge 1.25 cents per kw-hr.). In similar kitchens fired with coal, steam and gas the fuel cost per person per day is between 0.4 cent and 0.62 cent for the dining-rooms of the officials and 0.32 cent and 0.47 cent for the dining-room of the workingmen.—*Elek. Zeit.*, Oct. 22, 1914.

Effect of the War on the British Electric Supply Industry.—An article illustrated by diagrams and giving data for different cities. In many cases the output has benefited by increased motor load, but lighting has decreased with only a few exceptions. Load-factors have improved. There are a few instances in which outputs have suffered seriously, but for the most part the effect has not been unfavorable.—*London Elec. Eng'ing*, Nov. 12, 1914.

Austria-Hungary. — C. HONIGMANN. — An English translation of his recent German article giving statistical data on the electrical industry in Austria-Hungary. —London *Elec. Review*, Nov. 13, 1914.

Electrophysics and Magnetism

Magnetic Resistance Change of Pure Iron.—R. A. HEISING.—An account of an experimental investigation the main results of which are as follows: Electrolytic iron has a slightly greater rate of percentage resistance change for the longitudinal effect than ordinary iron. Iron, when transversely magnetized, does not increase in resistance at small fields, but continually decreases. Continual decrease of resistance in transverse case after saturation is proportional to internal H raised to the 0.85 power.—*Phys. Rev.*, October, 1914.

Magnetic Habits of Alloy Steels.—J. A. MATHEWS.—A paper read before the American Society for Testing Materials. The relationship between magnetic and physical characteristics of steel and its alloy has received much attention. No definite laws expressing this relationship have been found, although broadly considered there are similarities between magnetic and physical behavior which are very striking. In this paper, after briefly outlining the methods and scope of the work and describing the apparatus and units employed, the following subjects are dealt with: The suggestion of a new magnetic unit of magnetic hardness, B_r/H_c; that is, the ratio between residual density and coercive force is used to indicate magnetic hardness in a way similar to the use of μ to indicate permeability. The relation between hardness as measured by the Brinnel and Shore methods and magnetic hardness as indicated by B_r/H_c is discussed. It is shown that in hardened alloy steels the magnetic properties vary with the cross-section, but in some cases the magnetic hardness increases as the section increases, while in other cases the reverse is true, and in some alloy steels either condition may be had, depending upon the manner of quenching. It is shown that many alloy steels give lower induction, lower residual density and higher coercive force when quenched in oil than when quenched in water, the corresponding physical hardness test showing, as would be expected, that the water quenching confers the greater hardness. The effect of drawing the temper of hardened alloy steels is discussed, and it is shown that for equal drawing temperatures the magnetic properties of oil-hardened pieces are most affected, while as to the physical hardness the water-hardened pieces are affected to the greater degree.—*Proceedings, American Society for Testing Materials*, Vol. 14, 1914.

Electrochemistry and Batteries

Electrometallurgy.—J. W. RICHARDS.—A paper giving a review of the present status of electrometallurgy. The author divides his subject into electrolytic methods and electric furnace methods for the refining of metals and winning of metals from ore.—*Proceedings, Engineers' Club, Philadelphia*, October, 1914.

Units, Measurements and Instruments

Units and Notation.—The complete amplified list of notations adopted by the committee on units and notation (A. E. F.) of the German Association of Electrical Engineers. Notations: length l, mass m, time t, radius r, diameter d, wave-length λ, surface, F, volume V, angle, arc, α, β . . ., phase angle φ, speed v, angular velocity ω, number of revolutions per time unit n, number of cycles per time unit n, acceleration of gravity g, force P, pressure (force divided by surface) p, modulus of elasticity E, work A, energy W, momentum of a force M, power N, efficiency η, momentum of inertia J, centrifugal momentum C, normal tension σ, specific elongation ε, specific cross-contraction $\nu = 1/m$ (m Poisson's figure), friction coefficient μ, absolute temperature T, temperature measured from the ice point t or ϑ, which is to be used in formulas which also contain the time (the I. E. C. has amplified this rule by designating the absolute temperature with Θ and the Celsius temperature with ϑ), quantity of heat Q, mechanical equivalent of heat J, entropy S, specific heat c, specific heat at constant pressure c_p, specific heat at constant volume c_v, heat expansion coefficient α, calorific value H, light intensity J, magnetic field intensity $\mathfrak{H}$, magnetic flux density $\mathfrak{B}$, intensity of magnetization $\mathfrak{J}$, magnetic permeability μ, magnetic susceptibility $\varkappa$, electromotive force E, electric current I, electric resistance R, quantity of electricity Q, coefficient of self-induction L, electric capacity C. Symbols for units: meter m, kilometer km, decimeter dm, centimeter cm, millimeter mm, micron μ, arc a, hectare ha, square meter m^2, square kilometer km^2, square decimeter dm^2, square centimeter cm^2, square millimeter mm^2; liter l, hectoliter hl, deciliter dl, centiliter cl, milliliter ml; cubic meter m^3, cubic decimeter dm^3, cubic centimeter cm^3, cubic millimeter mm^3; ton t, gram g, kilogram kg, decigram dg, centigram cg, milligram mg; hour h, minute m or (if alone) min., second s; degree Celsius °, calorie cal, kilogram-calorie kcal; ampere A, volt V, ohm Ω, siemens S, coulomb C, joule J, watt W, farad F, henry H, milliampere mA, kilowatt kW, megawatt MW, microfarad pF, megohm $M\Omega$, kilovoltampere kVA,

ampere-hour Ah, kilowatt-hour kWh. The symbols for units are to be used only in connection with figures, but not in formulas. It is correct to write "the length is 500 m," but in formulas the name of the unit is written out or abbreviated (but not by its symbol); for instance, $E_1 = 4.44\nu N_0\Phi_1 \times 10^{-8}$ volt.—*Elek. Zeit.*, Oct. 22, 1914.

Telegraphy, Telephony and Signals

Neutralizing Transformers in Telephone Circuits.—THOMAS SHAW.—The neutralizing transformer is a special type of series transformer used for reducing low-frequency voltages electromagnetically induced in telephone and telegraph wires by adjacent energy-transmission circuits. The author describes the development of the device, gives the general theory of neutralizing action and construction of details and also discusses the limitations of the use of neutralizing transformers. An editorial by C. F. Scott gives further particulars of the evolution of this device.—*Elec. Journal*, November, 1914.

Mechanical Analogue of Coupled Circuits.—T. R. LYLE.—An abstract of a British Association paper in which the author gives a demonstration of an "exact mechanical analogy to the coupled circuits used on wireless telegraphy." Having derived a simple formula expressing the coupling angle between two inductively coupled circuits in terms of the inductances, he showed his model. It consisted essentially of a steel beam *M* (Fig. 2) built up of two parallel straight edges, 4 ft.

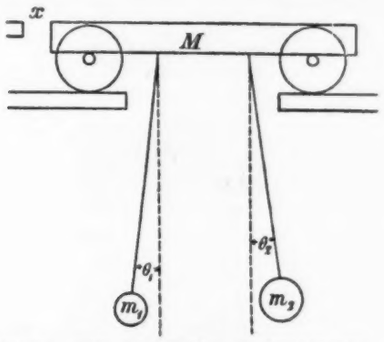


FIG. 2—MODEL FOR SHOWING MECHANICAL ANALOGUE OF COUPLED CIRCUIT

long, 3.5 in. apart, connected rigidly by aluminum distance-pieces and clamps, and resting with its edges on the overhanging axles of two pairs of steel disks, which were 1.5 in. apart and made from 5-in. slotting cutters (⅛ in. thick) by grinding off the teeth. The wheels rested on a carefully leveled plate of glass, all friction being so well reduced that the beam system, when once set in motion, would continue to oscillate to and fro for a long while. x indicated the distance of the beam from a stationary origin. Two pendulums, of masses m_1 and m_2, were suspended from cross-boards by means of V's, so that they could swing in the longitudinal space between the two members of the beam. The author showed that the angular displacements of the two pendulums were mutually connected by equations identical in form with those connecting the potential differences of the condensers in the corresponding electrical system. The relations of the resultant frequencies were best presented by the aid of a triangle the apex of which was the coupling angle. As described so far, the mechanical system was the analogue of the coupled circuits of a radiotelegraphic transmitter. The beam might itself be considered to represent the ether. The variation of the coupling was imitated by placing masses on two platforms at the ends of the beam. By increasing the load on the beam the coupling was diminished. When the beam was first steadied and then started by hand, and the one pendulum let go simultaneously, the second pendulum began to swing with increasing amplitude, while the amplitude of the first pendulum diminished. After a certain time the conditions appeared reversed, and so the transfer of energy forward and backward changed many times. These surgings could be calculated, and the advantages of loose couplings were demonstrated. The pendulum model also explained the theory of the quenched spark, as it was impossible to "break" the primary circuit without disturbing the whole mechanical system if the bob of the primary pendulum were not placed on its platform but taken in the hand so as to slacken the string. In order to imitate the conditions of a receiver when receiving signals, the first pendulum was made compound, and disturbances were transmitted to it from the beam by means of a simple electromagnetic device energized through flexible wires, for instance, by attaching one permanent bar magnet to the pendulum between two electromagnets on the beam. The model would also elucidate some of the problems arising in connection with the paralleling of alternators. The many models that others had described utilized rubber cords and steel springs, while inertia forces should alone be resorted to.—London *Engineering*, Nov. 13, 1914.

Book Reviews

HANDBOOK OF TABLES AND FORMULAS FOR ENGINEERS. Compiled by Clarence A. Peirce, with mathematical sections by Walter B. Carver. New York: McGraw-Hill Book Company, Inc. 168 pages. Price, $1.50.

In these days handbooks are constructed so massively as to raise the image of the mailed fist, but this little handbook, although containing a large amount of information useful to the engineer, is also a real pocketbook and weighs less than 150 grams. The book is divided into ten sections dealing with the following topics: Algebra, geometry and trigonometry, analytic geometry, calculus, measurement, physical and chemical properties of substances, mechanics, strength of materials, standard gages, fastenings and flanges, mathematical tables. The book is strong in its mathematical and mechanical sections. It will appeal particularly to the mechanical engineer but will interest all engineers.

RECHERCHES SUR LES PHÉNOMÈNES DE LA COMMUTATION. By J. Rezelman. Charleroi, Belgium: Librairie R. Lenders. 226 pages, 167 illus. Price, 7.5 francs.

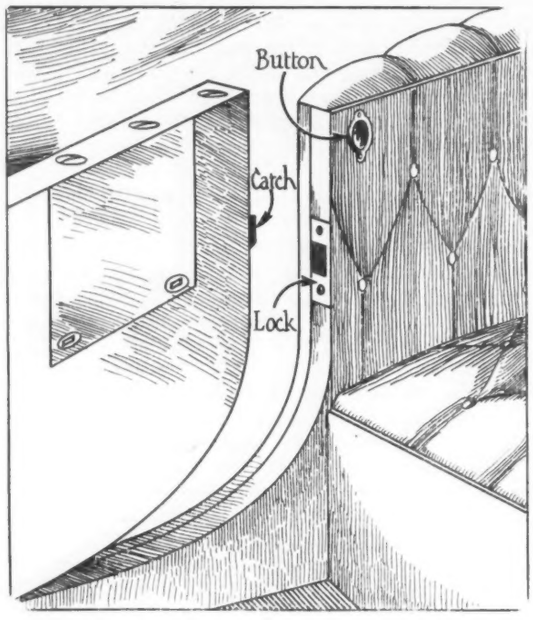
This volume gives an interesting quantitative account of certain experimental researches on commutation phenomena in a certain direct-current machine. The author sets out to determine, both experimentally and arithmetically, the reactance of one section of a drum armature, and also the mutual inductance between adjacent sections of different armatures, for various frequencies between 0 cycle and 200 cycles per second. The results are then applied to the behavior of a particular 100-kw machine using oscillograms, superposition of characteristics and a bismuth spiral. These researches will be of interest to direct-current machine designers and to all students of dynamo commutation. The book is divided into four sections, dealing respectively with the following subjects: Reactance determinations, rectilinear commutation, experimental applications, and the currents which circulate under the brushes.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Electrically Operated Automobile-Door Lock

The doors of the 1915-model light-weight cars built by the Scripps-Booth Company, Detroit, Mich., are equipped with electrically operated locks. The lock operates on the same principle as that of the main door



AUTOMOBILE DOOR WITH ELECTRIC LOCK

of an apartment house, which is unlocked by pressing a button in any one of the apartments. By means of a lock of this type the door handle is eliminated and the possibility of tearing one's clothes is therefore lessened. A mother-of-pearl push-button is set into the upholstery beside the door, as shown in the accompanying diagram. The button is so placed that one can grasp the door with one hand and press the button with the index finger of the same hand.

Cabinets Equipped with "Double Knock-Outs"

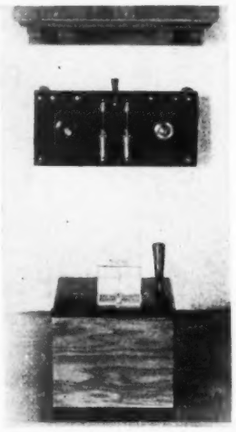
The cabinet shown in the accompanying illustration is provided with so-called "double knock-outs," which con-

CABINET WITH "DOUBLE KNOCK-OUTS"

sist of a plug knock-out within a plug knock-out. With a slight tap of a hammer the center slug will come out. If a larger hole is wanted, the remaining ring can be easily pulled out with a pair of pliers. The box is of stamped metal and is made in the following sizes: 6 in. by 6 in. by 3 in., 6 in. by 8 in. by 3 in., 8 in. by 10 in. by 3 in., 8 in. by 10 in. by 4 in., and 4.5 in. by 9 in. by 3.5 in. The cabinet has been approved by the Underwriters' Laboratories and is being manufactured by the Dill Manufacturing Company, 684 East Eighty-second Street, Cleveland, Ohio.

Workmen's Electric Time Recorder

An electrically operated time-recording machine consisting of a clock, panelboard and one or more registers for printing job tickets is being placed on the market by the Gisholt Machine Company, Madison, Wis. The clock may be placed in the superintendent's office, the cost department or the general office. The registers are usually placed near the foreman's desk beside a rack for the job tickets of the workmen. An eight-day weight-operated pendulum clock is employed. The working day



SWITCHBOARD AND RECORDER

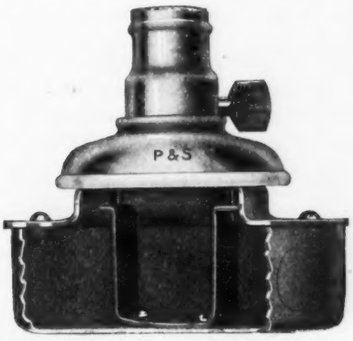
is divided into a certain number of units or periods. These periods are usually taken as tenths of an hour; that is, six minutes. The master clock is so arranged that it controls the operation of the registers for any pay period and permits the registers to advance only during the shop hours. By this method the numbers stamped on the job ticket represent net time only.

The panelboard, which is placed near the clock, consists of a slate panel on which are mounted a knife switch, clips for fuses, resistance units and a signal lamp. The recorder is designed for either direct current or alternating current. The registering machine has only one slot and one lever. Holes are punched in the bottom of the card so that if the workman tries to put his job ticket in upside down a pin drops into these holes and prevents him doing so. When the card is placed in the machine a number is stamped on it by moving the lever either forward or backward. This number represents a certain period. When the job is completed the workman again inserts the card and another period number is printed. The difference between the two numbers gives the amount of time put

on that particular work. At each printing a hole is punched in the card to prevent the workman stamping one number on top of another.

Conduit Box Strap

A strap for attaching receptacles to outlet boxes is shown in the accompanying illustration. It is designed especially for use with the pancake-type box and deep boxes having no lugs or ears. The device is made in

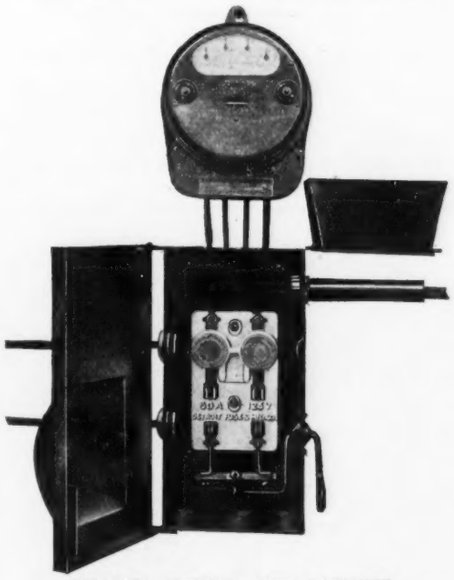


RECEPTACLE ATTACHED TO OUTLET BOX BY STRAP

two types, one for deep boxes and the other for shallow boxes. Either style may be used with or without the fixture stud. In the illustration this strap is shown attached to the fixture strap. The strap is being placed on the market by Pass & Seymour, Inc., Solvay, N. Y.

Entrance Switch and Cabinet

A service entrance switch and distributing cabinet recently developed are shown herewith. The meter is usually mounted above the cabinet. A meter trim is provided, and when it is in place and the door of the cabinet is locked tampering with the wires is obviated. The cabinet is equipped with knock-outs and there is considerable available space inside the box for wiring purposes. The "square D" cabinet, as it is called, is of



SERVICE SWITCH AND CABINET

sheet steel and is finished in black enamel. Both single-compartment and double-compartment cabinets are being made. The switch and cabinet is the product of the Detroit Fuse & Manufacturing Company. Detroit.

Demagnetizers

When iron and steel are brought in contact with a magnetic chuck they become more or less permanently magnetized. To counteract this action demagnetizing devices for use on alternating current and direct current have been developed by the D & W Fuse Company, Providence, R. I. The demagnetizing device consists essentially of a continuous U-shaped core made of lam-

DIRECT-CURRENT DEMAGNETIZER

inated steel, which is energized by two stationary coils through which alternating-current energy is passed. The upturned core ends are fastened to two surface plates across which the pieces to be demagnetized are passed. The core and the coils are inclosed in an oak box reinforced at the corners with metal strips. The surface plates project slightly above the top of the box. A switch for making and breaking the circuit and a cord are provided, and the box is equipped with handles, so that the device can be easily carried about from place to place. The direct-current demagnetizer is equipped with a small converter which changes the direct-current energy to alternating-current energy.

Cast-Iron Floor Box

A square cast-iron floor box developed by the Frank Adam Electric Company, St. Louis, Mo., is shown in the accompanying illustration. The thread in the box and that of the cover is of standard 3.5-in. pipe size, and therefore the contractor can use a standard tap to clean

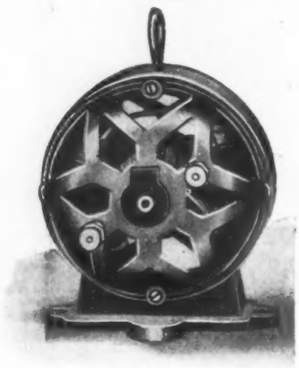
SQUARE FLOOR BOX

the threads in case they become rusty. The cover is of brass and is ⅛ in. thick and 5 in. in diameter. It is provided with a hole to take a standard round attachment plug in connection with a standard flush recep-

tacle, which can be supported on two special studs screwed into the bottom of the box. A nozzle is provided to screw into the brass cover; it is fitted with a gasket and is threaded at the top with a standard 0.75-in. pipe thread to take an insulating bushing. A cap equipped with a slot for screwdriver is also employed when the outlet box is not in service. The exposed parts are finished in polished brass. The above box has been designed particularly for use in post-office buildings.

Battery-Operated Motor

The motor illustrated herewith is designed for experimental and laboratory work, electroplating, lighting miniature lamps and operating small dynamos and machinery, and it will run on three or four wet or dry

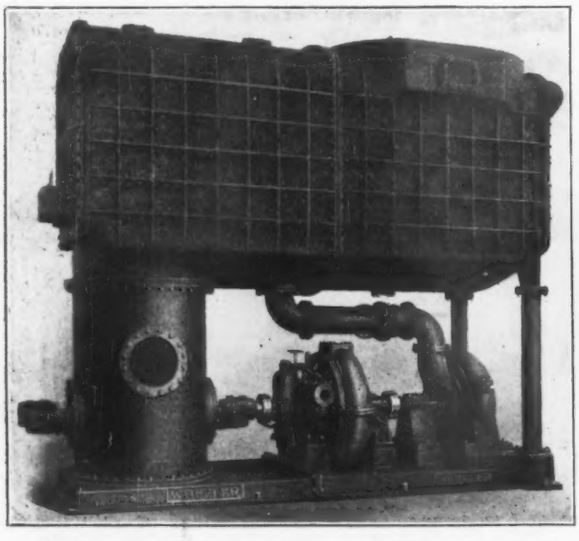


SMALL BATTERY-OPERATED MOTOR

cells. The motor is shunt-wound, and at a speed of 3500 r.p.m. its output is 6 volts and 3 amp. The armature is laminated and has twelve sections. A 1-in. grooved pulley is used with the motor. The apparatus complete weighs 6 lb. The motor is being made by the Menominee Electric Manufacturing Company, Menominee, Mich.

Rain-Type Counter-Current Jet Condenser

A rectangular rain-type counter-current jet condenser with turbine-driven self-contained auxiliaries is shown in the accompanying illustration. The condenser, which was built for the city of Seattle, Wash., by the



JET CONDENSER WITH TURBINE-DRIVEN AUXILIARIES

Wheeler Condenser & Engineering Company, Carteret, N. J., is capable of condensing 97,500 lb. of steam an hour and maintaining a 28.5-in. vacuum. The illustration shows the discharge of the tail pump, which is of the submerged type and is connected directly to its driving turbine. On the same shaft with this machine is the turbo-air pump. This arrangement makes a very compact and simple unit. Exhaust steam is delivered to the condenser at the top, so that the entire equipment is directly beneath the unit it serves.

Flashlamp Shaped Like a Fountain Pen

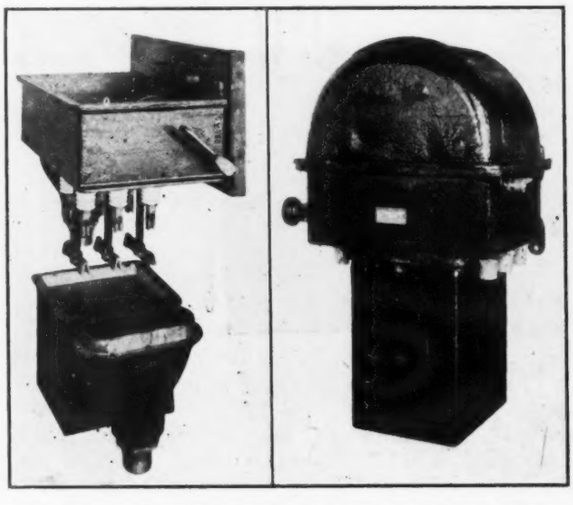
A compact flashlamp shaped like a fountain pen has recently been developed by the Beacon Miniature Electric Company, 108 Duane Street, New York. The device

"FOUNTAIN-PEN" FLASHLAMP

consists of a barrel, a cap and a clip. The end of the barrel holds the lamp and the cap incloses the battery. The circuit is closed when the clip is pressed against the casing. When placed in a pocket with the cloth between the clip and the cap the device is held securely, and in this position the lamp cannot be lighted, as the cloth acts as an insulator.

Oil Switches for Manhole Service

Two types of manhole oil switches for mounting on flat vertical surfaces have recently been developed by the General Electric Company, Schenectady, N. Y. One of the switches is designed for hand operation and the



FIGS. 1 AND 2—HAND SWITCH AND SOLENOID SWITCH

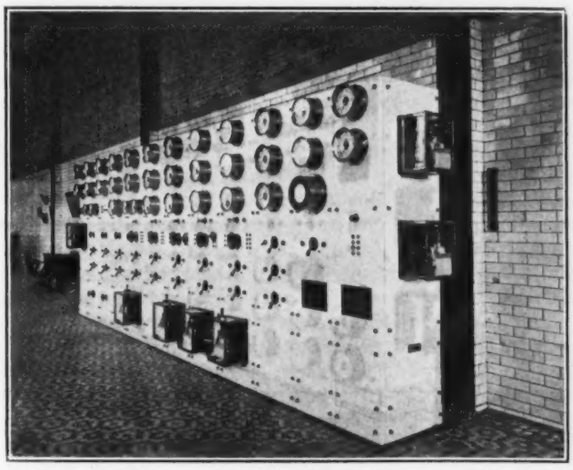
other is worked by a solenoid that is part of the switch.

In the hand-operated switch there are two bell chambers through which run the leads to and from the switch. After the leads are connected to the switch terminals the chamber is filled with an insulating compound and made air-tight. The bell chambers as well as the oil vessel and cover are of cast iron. They are bolted to the cast-iron switch frame, the joints being made water-tight by gaskets. The operating handle is outside the frame and can be operated by a hook from the entrance to the manhole. The shaft handle passes through a stuffing box.

The solenoid-operated switch is as a rule operated by a control switch in the central station. The plunger of the solenoid is directly connected to the crosshead attached to the operating rods. The switch solenoid is energized only when the switch is being closed or opened. The switch is closed by a catch, and it opens by gravity when the switch is thrown out of position either by the trip-coil plunger or by a small tripping lever outside the switch frame. Both switches are equipped with an indicator, which can be seen from the top of the manhole and shows whether the switch is open or closed.

Large Glass Switchboard

Recent developments in the making, beveling and drilling of massive slabs of glass have made it possible to utilize this substance in the construction of switchboards. In the accompanying illustration is shown a glass switchboard built for Dodge Brothers, Detroit, Mich., by the Mutual Electric & Machine Company, Wheeling, W. Va., which is declared to be one of the largest switchboards of this type ever made. The board is of white Carrara glass and is 1.5 in. thick. All instruments are finished in golden bronze to add to the pleasing appearance of the apparatus as a whole. The board is in the engine room and is used only for control purposes. The generator and feeder switches are operated by solenoids and motors and are on additional switchboards in the basement and other parts of the factory. Mounted on the switchboard is a set of remote-control field discharge switches and "I-T-E" motor-operated circuit-breakers. To the left and right of the control switches on the glass board are mounted red and green signal lamps. The board is used in connection with the control of two 480-volt, 750-kw, three-phase, 60-cycle, steam-turbine units, one 500-kw, three-phase Corliss-engine directly connected unit, one engine-driven exciter and two motor-generator exciter units.



GLASS SWITCHBOARD

15,000-Ohm Resistance Unit

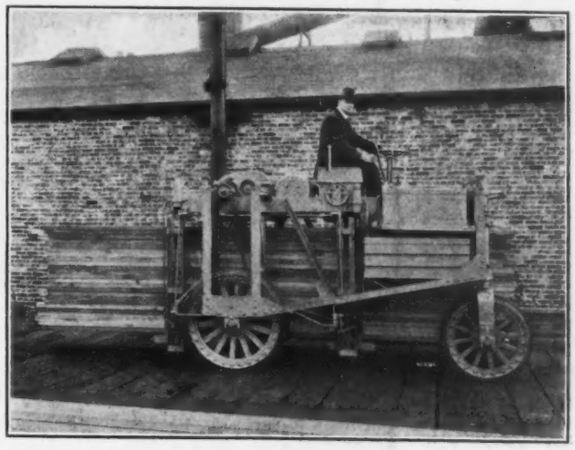
A 15,000-ohm resistor, 4 in. long and 7/16 in. in diameter, with a rating of 40 watts, has been developed by the Ward Leonard Electric Company, Bronxville,

RESISTANCE UNIT

New York. The resistance wire, it is declared, has a temperature coefficient which is practically zero. The wire is in one layer and is protected against oxidation or depreciation. The unit can be employed with a fuse-clip or screw-base mounting.

Electric Truck for Hauling Lumber

The electric truck shown herewith has recently been designed by the Stetson-Ross Machine Works, Seattle, Wash., and is equipped with "Ironclad-Exide" batteries manufactured by the Electric Storage Battery Company, Philadelphia, Pa. The truck is made of angle irons and I-beams, which are riveted together. The wheels are fitted with solid rubber tires, and springs are provided only under the front wheels. The motor-gear case and jack-shaft are directly behind the driver's seat. The controller is underneath the seat and the batteries are mounted on each side. The truck is designed to be driven directly over a pile of lumber which has been previously raised about 6 in. from the ground. By means of a lever on the side of the driver's seat two side frames, one on each side of the truck, are forced against the pile of lumber and locked into place. After the side frames have been locked in place, the driver's clutch is shifted and the motor is used to hoist the lumber clear of the ground. To unload the truck the cables are released and are controlled by a brake.



ELECTRIC LUMBER TRUCK

Jobber, Dealer and Contractor

Sales Campaign Doubles Contractor's Fan Business

Although four contractors and the central-station company handle fans in Springfield, Mo., the Electrical Equipment Company, a contracting firm, did a greater fan business than all of its rivals combined. Mr. J. T.

ELECTRICAL EQUIPMENT CO.,
CITY.

GENTLEMEN:

I am interested in electric fans for my

(State whether Office, Store or Home.)

Please have your representative call, giving me your terms and quoting me your very best price. It is understood that this does not obligate me in any way.

Yours very truly,

Name

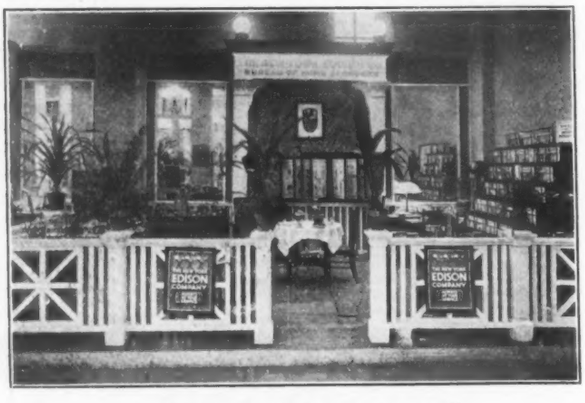
Street No.

MAILING CARD USED IN FAN SALES CAMPAIGN

Coon, manager of this successful concern, attributes the company's large fan business mainly to aggressive sales effort. At the opening of the fan season circular letters exploiting fans were mailed to practically every user of electricity on the lines of the Springfield Gas & Electric Company. An addressed and stamped post card, similar to the one shown herewith, was sent with each letter. A great many of the cards were filled in and returned, and salesmen following these inquiries were singularly successful. The company's total fan sales for the year were more than twice as great as its sales for any previous season.

Bureau of Home Economics to Stimulate Demand for Electrical Appliances

The New York Edison Company has recently established a Bureau of Home Economics to disseminate information regarding the nutritive values of foods, to persuade housekeepers that efficiency and economy in the home are greatly increased by electrical equipment and to serve as a place of reference regarding household



"BUREAU OF HOME ECONOMICS"

appliances. By extending this service and gaining the confidence of housekeepers the company hopes ultimately to increase the demand for electrical household appliances and consequently electric service. Information collected by this bureau will be presented to the public through magazine articles and by lectures and demonstrations on the production and conservation of bodily energy, economy and efficiency as applied to the household, household administration, cooking by electricity, etc.

So far 400 women have registered with the bureau and have requested that they be notified of its lectures. High-school and normal-school teachers, domestic-science schools, etc., are being advised regarding dietetics and technical characteristics and operation of electrical appliances. The bureau is co-operating with women's clubs, home economic associations and domestic-science clubs for the delivery of lectures bearing on the use of electrical devices. The bureau was also represented at the Electrical Exposition and Museum of Safety Exhibits held recently in New York City. Data on the nutritive values of foods and a booklet entitled "Household Engineering," stating the cost of operating various electrical devices, have been distributed quite generally. Return post cards stating the aims of the bureau are now being prepared, by means of which persons can request information available from the bureau.

Plans have been made to equip one floor of the company's Forty-second Street building as a model apartment house. Apparatus for this exhibit will be solicited from all manufacturers for display purposes. These devices will be tested and the results with the method of economic operation will be shown by Misses A. M. East and I. J. Zimmer, who are in charge of the bureau. In this way housekeepers will be enabled to select devices on their merits and will in addition receive the consulting service of these women, who are specially qualified to talk on the energy values of different foods. Miss East is at present visiting appliance manufacturers in the West for the purpose of acquainting them with the aims of the bureau, obtaining information regarding new devices, pointing out the weak points of appliances now manufactured, and describing operation which might be performed by electricity. Eventually teas and informal talks will be given at the bureau headquarters. Orders for appliances will be taken by the bureau, but will be transferred to the manufacturers for filling. The bureau will, therefore, act as a retail jobber, but will receive no commissions from manufacturers or fees from purchasers for its services.

Lively Electrical Supply Business in Kansas and Missouri

Traveling among the jobbers, contractors and central-station men in Kansas and Missouri, and repeatedly asking the question, "How's business?" a representative of the *Electrical World* finds that snap switches, lamps, sockets and the other electrical details and supplies are still being sold in quantities indicating lively trade conditions. Jobbers and dealers tell the same story everywhere. They say: "Our sales of small devices are as good as ever, if not better," but they generally qualify the statement by saying that larger apparatus is not moving rapidly. Jobbers in Kansas City, Mo., are optimistic and speak spiritedly of the good wheat crop in Kansas. They also point with pride to the increasing bank clearings at Kansas City, which have recently overstepped all precedent and gone above the clearings at St. Louis. Contractors in some of the medium-sized cities report that their 1914 business will be the greatest in the history of their firms.

In nearly all cases these dealers do not hesitate to assign their success to good crops, active central-station co-operation and aggressive sales effort.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Electric Aluminum Percolator.—The Hotpoint Electric Heating Company, Ontario, Cal., has recently improved its "El Perco" percolator. Instead of the usual cast spout a pressed-sheet aluminum spout is used. The above company is preparing to manufacture 20,000 of these percolators.

Small Motor Business Good.—The Electric Operations Company, formerly the McLeer Electric & Manufacturing Company, Bush Terminal, Brooklyn, N. Y., is noting a good demand for its small-sized motors. This company is also engaged in the repair of motors manufactured by other companies.

Electric Toys Received Before War.—The Manhattan Supply Company, 17 Park Place, New York, received a large shipment of electric toys from Germany before the European war began. Business for this company in small battery-operated and motor-driven devices suitable for Christmas presents is good.

Fan-Motor Business Picking Up.—An improvement in the fan-motor business has been noted by the Menominee Electric Manufacturing Company, Menominee, Mich. The company is also receiving many orders for other types of small motors. The business in toy motors is not so good as it was at this time last year.

High-Efficiency Tungsten Lamp Load at Louisville.—Since the first of October the commercial department of the Louisville (Ky.) Gas & Electric Company has been conducting a campaign to popularize the use of nitrogen-filled tungsten lamps in Louisville. Since the beginning of the campaign a total of more than 100 kw of this type of lighting load has been added to the company's lines.

No Shortage of Electrical Toys from Germany.—John Bing, 381 Fourth Avenue, New York, representing Bing Brothers, Nuremberg, Germany, is receiving shipments of electrical toys from Europe in spite of the war. The above concern manufactures various types of electrically operated miniature trains, electric railway-signal systems, miniature electric cranes, etc. A large supply of electric toys from Bing Brothers is now on hand at the New York establishment.

Electrically Operated Reversible Planer.—The Allis-Chalmers Company, Milwaukee, Wis., has developed a compound-wound motor for use with reversing planers. The motor is equipped with four commutating poles which are connected in series with the armature. The machine is automatically reversed at the end of the cutting and return strokes. The control equipment and brake employed with the motor are being made by the Electric Controller & Manufacturing Company, Cleveland, Ohio.

Flashlamp Company's Business Good.—Although comparatively a new concern, the Beacon Miniature Electric Company's business in flashlamps has been very good. The company has recently developed a small vest-pocket-size flashlamp shaped like a fountain pen. This device has a clip so that it can be fastened to the pocket in the same manner that one fastens a fountain pen. This lamp, it is declared, is meeting with considerable favor. The above company is also an importer of special small-sized decorative lamps for trimming Christmas trees. These lamps come chiefly from Germany, and on account of the war it is very difficult to obtain regular shipments. The offices of the above company are at 108 Duane Street, New York.

Toy Transformers.—The Dongan Electric Manufacturing Company, 741 Franklin Street, Detroit, Mich., has recently improved its type "F" and "master" toy transformers. These transformers are of the lever-control design and are equipped with a small low-voltage fuse in the secondary or low-voltage windings. In case of a short-circuit of the toy or if a train should jump the track, causing a short-circuit, the fuse will be blown, thus protecting both the transformer coils and house fuses. Being of the standard 6-volt automobile type, the fuse can easily be replaced. The popularity of these transformers for use in operating toy motors, miniature trains and similar devices during the holiday season last year was marked.

Shallow Flush Push-Button Switches.—The Chelton Electric Company, Philadelphia, Pa., is manufacturing shallow flush push-button switches which are meeting with favor in residences, apartment houses, hotels, etc. Installations of these devices have been made in the following buildings: Woodward Building, Washington, D. C.; Empress Hotel, Victoria, B. C.; Detroit Athletic Club, Detroit, Mich.; the Brighton Apartments, Washington, D. C.; E. T. Stotesbury residence, Philadelphia, Pa.; Asylum for Insane, Battleford, Sask.; Philadelphia Stock Exchange, Philadelphia, Pa.; the Dresden Apartments, Washington, D. C.; Vassar College, Poughkeepsie, N. Y.; State Capitol, Albany, N. Y.; Charlevoix Apartments, Cleveland, Ohio; Trinity Court Apartments, Boston, Mass.; Campbell Building, Victoria, B. C.; General City Hospital, Winnipeg, Manitoba; American National Bank, San Diego, Cal.; Alcazar Hotel, Vancouver, B. C. The above company also manufactures various types of switch boxes, clamps, etc.

Hydroelectric Power Plant Contract Awarded in Massachusetts.—The Amherst Power Company, whose headquarters are at Greenfield, Mass., has awarded contracts for the construction of a 36,000-kw hydroelectric plant at Montague City, near Turners Falls, to Fred T. Ley & Company, of Springfield, Mass., and to Thomas Brothers, Turners Falls. The former will handle the steel and concrete work and the latter the brickwork and masonry. The generating plant will be 150 ft. by 96 ft. and 56 ft. high, with an operating room 45 ft. by 50 ft. in dimensions. Work will be started immediately, and it is planned to begin the installation of machinery on March 1, 1915. Energy will be supplied from this plant to the high-tension network of the company in the central Connecticut Valley, which includes 70,000-volt transmission lines connecting with the system of the United Electric Light Company at Springfield, connections to the auxiliary steam-turbine plant of the company at Mount Tom Junction, and arrangements for the sale of energy for industrial purposes in the Turners Falls district. The Cabot interests, of Boston, are in control of the project.

Earnings of Byllesby Utility Properties.—Consolidated net earnings of the utility properties managed by H. M. Byllesby & Company, Chicago, for October were 10.7 per cent greater than for the same month of 1913. For the ten months ended Oct. 31 the gain in net was 7 per cent. The October showing, therefore, was considerably better than the average for the year thus far and bears out the contention that war conditions have not seriously impaired the net earnings of electric and gas companies, although the gain in gross is not so satisfactory. The Byllesby group of properties is fairly representative as it includes the subsidiaries of the Standard Gas & Electric Company, the Northern States Power Company and the Western States Gas & Electric Company, operating in sixteen states of the Middle West, West and South. The consolidated earnings of the Byllesby properties for October were: Gross, $1,201,703; net, $592,408, an increase over October, 1913, of $20,150 and $57,255 respectively. For the ten months ended Oct. 31 the earnings were: Gross, $11,721,-719; net, $5,421,606, an increase over the corresponding months of 1913 of $289,334 and $355,723 respectively.

Corporate and Financial

Money Invested Best Value for Rate Fixing.—H. F. McConnell & Company, of New York, in reference to public utility securities said: "The amount of money invested in a public utility property is the best evidence of value for rate-fixing purposes."

Panama Canal and Pacific Coast.—The *Commercial and Financial Chronicle* has issued with the current number an extra section on the Panama Canal and the Pacific Coast. Special articles are contributed by men of prominence. A portion of the book is reserved for descriptions of the securities and reports of industrial and public service companies and banks of the Far West.

Seven Cities Company Out of Temporary Receivership.—Mr. C. M. Garsaway, general manager of the Seven Cities Company of Russellville, Ark., stated that the company went out of temporary receivership early in November and that litigation has been dismissed by compromise. Mr. A. Brewster is chairman of the board of directors, and Mr. Henri Chouteau is president of the company.

Proceeds from Consolidated Gas Debentures.—The proceeds from the $25,000,000 of debentures authorized recently by the Public Service Commission, First District, are to reimburse the company for money expended in acquiring capital stock of the New York Edison Company and the Astoria Light, Heat & Power Company; also to discharge $5,000,000 of collateral-trust notes and $2,500,000 of demand notes.

Republic Railway & Light Sells Assets of Subsidiaries.—The Republic Railway & Light Company, of Youngstown, Ohio, announces progress on the plan for unifying the corporate organization of the companies. Assets of the Youngstown-Sharon Railway & Light Company and Sharon & Newcastle Railways Company have been sold to the Mahoning & Shenango Railway & Light Company, and the two former companies have been dissolved.

Lighting Companies Come Under Court Control. — The court control in Kansas City, Mo., which heretofore had embraced only the Metropolitan Street Railway Company, was extended Monday by Judge Hook to include the Kansas City (Mo.) Electric Light Company and the Standard Electric Company of Kansas City, Kan. The lighting companies are in effect operating now under receiverships subject to the court, except that no receivers have been appointed.

Pacific Gas & Electric Purchases Notes.—In response to its request for tenders of $2,500,000 of one-year 5 per cent gold notes, due March 25, 1915, the committee, composed of the Bankers' Trust Company of New York, Harris, Forbes & Company and N. W. Halsey & Company, received tenders of $3,751,000 of notes. The company purchased $2,511,000 of these notes at prices which netted approximately 1 per cent in comparison with the call price of the notes.

Northern California Power Company Assessment.—The assessment of $2 per share recently levied by the Northern California Power Company had raised $130,000 on Nov. 7, according to a statement by the secretary, who also said that many of the large stockholders had not yet paid but had expressed their intention of paying before the day of the delinquent sale. By delaying action these stockholders save interest and lose only about $1.50, the cost of the advertisement.

Ohio Light & Power Bond Offering.—Perry, Coffin & Burr, of Boston, and N. W. Harris & Company are offering at 90 and interest $1,200,000 of first mortgage 5 per cent gold bonds of the Ohio Light & Power Company, of Tiffin, Ohio. The bonds are dated May 1, 1914, and are due on May 1, 1944. They are secured by a first mortgage on all the property and franchises of the company, which does the entire commercial and, with one exception, the entire municipal electric lighting and motor-service business of eleven cities and towns in the central and northwestern sections of Ohio. The population served is estimated to exceed 100,000. The company is controlled by the American Gas & Electric Company of New York.

The Ohio Service Company.—The Ohio Service Company has been organized recently for the purpose of consolidating four separate companies in the counties of Guernsey, Tuscarawas and Coshocton, Ohio, namely, the County Electric Company, Twin City Traction Company, New Midland Power & Traction Company, and Lafayette Light & Power Company. The corporate existence of the Tuscarawas County Electric Light & Power Company, which has been held alive but has not been an operating company, will be ended. The merger will take place as soon as the respective mortgages can be satisfied. For the purpose of refunding these mortgages the Ohio Public Service Commission has authorized the Ohio Service Company to issue $925,808 three-year notes. Most of the bonds, as well as all the stock of the various companies, are owned by the United Service Company of Scranton, Pa., so that only a little over $250,000 notes will be held in reserve to refund bonds not immediately obtainable. It is stated that all the outstanding bonds will be obtained within the three years, and then a twenty-year first mortgage bond issue will be made and the three-year notes retired.

Annual Report of Virginia Railway & Power.—The annual report of the Virginia Railway & Power Company for the year ended June 30, 1914, shows gross earnings of $5,156 048; deducting $2,565,908 for operating expenses, including depreciation, and adding $80 910 for other income, leaves $2,671,050 as gross income. When fixed charges and rentals of $1,307,348, taxes and licenses of $308,112 and direct charges of $83,685 were deducted from gross income a surplus of $971 905 was left. Dividends of $781,949 left a surplus of $189,956. Expenditures for maintenance of way and equipment were increased during the fiscal year to 16.01 per cent of gross earnings, as compared with 14.99 per cent for the fiscal year ended June 30, 1913. In addition to the regular charges for maintenance of way and equipment, $100,000 was set aside in cash in monthly instalments during the year as a depreciation reserve and charged to operating expenses. President Thomas S. Wheelwright states: "The company has continued its policy of liberal expenditures for maintenance of property and equipment during the past year and has carried forward comprehensive plans for improvements with a view to keeping the physical and operating conditions up to, or in advance of, the needs of the service."

Shoshone & Twin Falls Refinancing Plan.—The bond-secured note holders' protective committee of the Shoshone & Twin Falls (Idaho) Water-Power Company has deposits, in accordance with the agreement for refinancing of July 27, 1914, of approximately 70 per cent of the outstanding notes. Only a very small amount of the matured notes has been deposited. Holders of the matured notes, claiming that by reason of their maturity they should be paid, refused to accept the plan of July 27 without modification, and therefore the committee has presented a modified form for refinancing. It states that the outstanding $115,000 first mortgage bonds may be surrendered by holders in exchange for $92,000 of 6 per cent bond-secured notes to be deposited with the committee. The total outstanding notes will then be $1,872,000, to be secured by $2,340,000 first mortgage bonds. The committee will cause the property to be sold for the benefit of depositing note holders and conveyed to a new company. The new company shall issue its entire full-paid, non-assessable capital stock in payment for the property, in amount equal in par to the face value of the 6 per cent notes deposited. The American Water Works & Electric Company, a creditor, shall advance as the committee may call upon it the reasonable expenses of foreclosure and reorganization. The entire stock of the new company shall be deposited in escrow with the Commonwealth Trust Company, of Pittsburgh, which shall issue certificates of participation of par value equal to the notes. Such certificates shall be distributed to depositing note holders pro rata, who will receive cash equal to accrued interest upon their notes from the date of issuance of the certificates. The American company shall pay holders of the certificates every six months for a period of five years 6 per cent interest on the par value of the 6 per cent exchanged collateral notes. The American company shall have the option at any time within five years to purchase the entire stock of the new company by paying in cash the par value of the deposited notes with accrued interest at 6 per cent. The members of the committee are Messrs. Alvin W. Krech, H. Hobart Porter and A. C. Washington Robinson.

WESTERN COMPANIES DO WELL

Electric Utilities of the Pacific and Mountain States Show a Satisfactory Growth—Companies in Small Towns Experience Surprisingly Large Increase

The returns for September operations from the companies in the Pacific and Mountain States show approximately a 4 per cent growth over the corresponding period of the preceding year. A glance at the 1913 column will show that September in the West is naturally a dull and quiet period. It is indeed surprising that the companies should show a growth during this time, especially when one takes into consideration the added depression of the present year.

TABLE I—COMPARATIVE RETURNS FROM COMPANIES IN SIX LARGE CITIES IN CALIFORNIA, WASHINGTON, OREGON, UTAH AND COLORADO, REPRESENTING OVER 60 PER CENT OF ELECTRIC UTILITY INDUSTRY OF PACIFIC AND MOUNTAIN STATES

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
June	$1,639,297	$1,559,596	5.1	140,494,562	129,504,858	8.5
July	1,645,688	1,531,493	9.6	144,776,151	131,387,904	10.4
August	1,642,096	1,595,891	3.0	145,646,901	140,920,218	3.4
September	1,705,518	1,675,800	2.4	141,335,639	139,320,517	1.5

Figures in Table I need no comment. It will be noted by reference to Table II that companies in small cities in the West did better in September than in any of the four previous months. By comparing Tables III and IV it will also be noted that the Pacific States had a better growth rate in output and a poorer growth rate in income than the Mountain States during September. Companies in the Mountain States have for some time past been making a special effort toward increasing their domestic customers. One large company stated that the motor-service load was so uncertain that special efforts had to be made to increase the number of domestic users of electrical energy. Table V shows that while there has been a depreciable loss in the income growth rate, the great loss came in the output growth rate.

TABLE II—COMPARATIVE RETURNS FROM COMPANIES IN SIX SMALL CITIES IN NEW MEXICO, ARIZONA, WASHINGTON, WYOMING AND IDAHO, REPRESENTING LESS THAN 1 PER CENT OF THE INDUSTRY OF THE PACIFIC AND MOUNTAIN STATES

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May	$55,828	$54,103	3.3	1,613,341	1,770,549	*8.8
June	54,753	55,596	*1.5	1,262,268	1,645,528	*23.3
July	58,250	56,305	3.5	1,488,635	1,756,973	*15.2
August	59,361	54,718	8.3	1,649,420	1,747,405	*5.5
September	62,872	56,190	12.0	1,843,610	1,676,564	10.0

*Decrease.

Industrial conditions during the month of September in the Far West were far from being good. While business picked up some toward the end of the month, in the first half business was decidedly irregular and unusually dull. The Mountain States reported cheerful indications in the first week in September with heavy orders for winter goods. While the retail trade was generally dull in the Mountain States in this month, it was unusually so in the second week of September. In the third week the general business had somewhat improved, especially in the drug trade. The steel mills were running on half time because there was practically no demand for rails. In the fourth week there was little change. Conditions, however, were promising. The indications were favorable the first week along the Coast, and an improvement was generally expected. During the second week, however, there was considerable irregularity, depression in many lines and improvement in others; sales were diminished and prices advanced. The Northwest was considerably helped by the excellent salmon market. Lumber was very much depressed, but flour millers were doing very well. A good trade has been developed

TABLE III—COMPARATIVE RETURNS FROM OVER 60 PER CENT OF THE CENTRAL-STATION INDUSTRY OF THE PACIFIC STATES OF CALIFORNIA, WASHINGTON AND OREGON

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
June	$1,329,041	$1,251,956	6.2	110,466,824	102,761,425	7.6
July	1,323,118	1,245,135	6.2	114,993,629	106,422,888	8.0
August	1,331,820	1,290,076	3.2	119,418,013	114,033,423	4.8
September	1,397,664	1,357,338	3.0	116,465,943	112,570,232	3.7

TABLE IV—COMPARATIVE RETURNS FROM OVER 80 PER CENT OF THE CENTRAL-STATION INDUSTRY OF MOUNTAIN STATES OF COLORADO, NEW MEXICO, UTAH, ARIZONA, WYOMING, NEVADA AND IDAHO

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
June	$565,846	$539,962	4.8	44,859,631	39,074,902	14.8
July	586,453	528,292	11.0	44,686,495	37,832,222	18.0
August	604,612	582,021	3.8	47,038,849	44,714,822	5.2
September	603,018	577,413	4.0	40,642,974	40,953,155	*0.7

*Decrease.

TABLE V—RETURNS RECEIVED FROM THE CENTRAL-STATION INDUSTRY OF THE PACIFIC AND MOUNTAIN STATES

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Pe Cent Increase
May (60 per cent of industry)	$1,525,729	$1,426,885	7.0	144,839,552	129,357,915	11.9
June (70 per cent of industry)	1,894,887	1,791,918	5.8	155,326,455	141,836,377	9.6
July (75 per cent of industry)	2,212,827	2,068,249	6.8	183,160,015	169,718,387	7.9
August (78 per cent of industry)	2,386,677	2,282,061	4.6	193,216,699	185,330,705	4.2
September (78 per cent of industry)	2,487,513	2,398,176	3.7	190,979,705	185,090,658	3.2

in the Orient for paper pulp, paint and preservatives. The enormous tie-up in shipping, however, was a great hindrance to the export trade. In the third week general business was still quiet, but some lines were recovering, with many becoming fairly active. Prices were generally higher. The activities of the wheat market made a very irregular trade for the millers. The sugar refineries were preparing for increased business and manufacturing developments were generally active, owing to a decision of the Interstate Commerce Commission in reducing eastbound rates. In the fourth week business was not very active, although it was somewhat better. The outlook became rather encouraging.

Business Notes

The Menominee Electric Manufacturing Company.—L. M. Wood, formerly sales manager for the Menominee Electric Manufacturing Company at Menominee, Mich., is now sales manager of the territory designated as the southern district, and his headquarters are at St. Louis.

The Edison Storage Battery Company, Orange, N. J., has appointed W. F. Bauer manager of its Chicago office to succeed C. B. Frayer, who has retired to devote himself to private interests. Mr. Bauer was formerly connected with the Electric Accumulator Company, the Westinghouse Electric & Manufacturing Company and the Pullman Company.

Reed & Leonard.—C. G. Reed and C. Leonard have formed a partnership to deal in electrical material and will represent manufacturers of Baltimore, Washington and vicinity. The office of this firm will be at No. 705 American Building, Baltimore, Md. Both Mr. Reed and Mr. Leonard were formerly connected with the Westinghouse Electric & Manufacturing Company. The above firm will succeed the establishment of Clinton G. Reed, 100 West Fayette Street, Baltimore, Md.

New Industrial Companies

The Flanders Electric Company, of Chicago, Ill., has been incorporated with a capital stock of $25,000 to manufacture electrical appliances. The incorporators are J. P. O'Shaughnessy, J. P. Rosen and J. L. Toohey, of Chicago.

The Caledonian Electric Company, of New York, N. Y., has been incorporated with a capital stock of $5,000 to manufacture motors, machinery, fixtures, etc. The incorporators are H. A. Malcolm, T. G. Canon and J. J. Rafferty, 30 East Forty-second Street, New York, N. Y.

The Huron Bay Construction Corporation, of New York, N. Y., has been chartered with a capital stock of $25,000 to do a general civil, mechanical, electrical engineering and contracting business. The incorporators are C. V. Fanning, of Greenport; W. J. Cunningham, of Richmond Hill, and H. Speicher, of Glendale, N. Y.

Trade Publications

Hickeys.—The Wilton Manufacturing Company, Wrightsville, Pa., has published Bulletin No. 32, entitled "The Wi-co Hangstrait Hickey."

Steel Boxes.—Steel service and cut-out boxes are the subject of a leaflet issued by the Electric Operations Company, Bush Terminal, New York.

Motor Starters.—Automatically controlled motors are the subject of a bulletin being printed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Electric Drill.—A drill operating on either alternating or direct current is referred to in a folder issued by the Van Dorn Electric Tool Company, Cleveland, Ohio.

Arc-Lamp Controller.—The Speed Controller Company, 257 William Street, New York, has issued several booklets which describe its motor-driven arc-lamp controller.

Applications of Ball Bearings.—"Ball Bearings and Their Correct Use" is the subject of folders sent out by the Hess-Bright Manufacturing Company, Philadelphia, Pa.

Insurance for Utilities Companies.—The Utilities Mutual Insurance Company, 51 Wall Street, New York, has issued a booklet entitled "Insurance at Absolute Cost."

Field Rheostat.—The Ward Leonard Electric Company, Bronxville, N. Y., has issued Circulars No. D13 and D14, which describe a recently developed 6-in. field rheostat.

Ball Bearings.—Ball bearings for paper-making machinery are described in Bulletin No. 21, published by the SKF Ball Bearing Company, 50 Church Street, New York.

Underfeed Stokers.—The Sanford Riley Stoker Company, Worcester, Mass., has published a thirty-two-page illustrated catalog which describes its self-dumping underfeed stokers.

Insulating Material.—A forty-six-page catalog describing various insulating materials placed on the market by the Continental Fire Company, Newark, Del., has recently been published.

Annunciator Target.—An electrically reset annunciator drop which is unaffected by vibration is described in a catalog issued by Edwards & Company, 140th Street, New York City.

Table for Electric Sewing Machine.—A convertible table for motor-driven sewing machines is described and illustrated in a leaflet issued by the Bissell Motor Company, Toledo, Ohio.

Molded Insulation.—In a thirty-six-page catalog recently published by the Boonton Rubber Manufacturing Company, Boonton, N. J., are described various substances used for insulating purposes.

Milk Clarifiers.—Motor-driven centrifugal milk clarifiers capable of handling 100 lb. to 2000 lb. of milk an hour are illustrated in a folder published by the De Laval Separator Company, New York City.

Railway Motors.—The General Electric Company, Schenectady, N. Y., is sending out Bulletin No. 44,404, which describes a recently developed 600-volt ventilated commutating-pole railway motor.

Tools for Christmas Presents.—Descriptions of tools suitable for Christmas presents are described in a folder recently issued by the Smith & Hemenway Company, 150 Chambers Street, New York.

Electrical Devices for Christmas Presents.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued an attractive folder which lists various devices suitable for Christmas gifts.

Automobile Lighting Switches.—The Hartman Electrical Manufacturing Company, Mansfield, Ohio, has issued a bulletin designated as No. 10, which describes lighting switches and starter switches for automobiles.

Combined Volt-Ammeter.—In a folder sent out recently by the Hoyt Electrical Instrument Works, Penacook, N. H., is described a double-faced instrument for measuring the voltage and current in a circuit simultaneously.

Storage Batteries.—"The Dry Battery: A Symposium," is the subject of a leaflet which enumerates some of the features of dry batteries and which is issued by the Nungesser Carbon & Battery Company, Cleveland, Ohio.

Automatic Pumping Equipment.—Features of the Eureka motor-driven automatic pumping equipment are given in a leaflet which is being distributed by the Bishop-Babcock-Becker Company, 431 Lafayette Street, New York City.

Distributing Transformers.—Bulletin No. 1088, published by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., describes and illustrates various types of distributing transformers. This bulletin supersedes Bulletin No. 1077.

Electric Cooker.—An electric-steam oven which will automatically maintain a uniform temperature and start cooking at a definite time is described in a booklet prepared by the Berkeley Electric Cooker Company, 228 Monadnock Building, San Francisco, Cal.

Transformers for Stop-Motion Equipment.—The General Electric Company, Schenectady, N. Y., has just issued a bulletin designated as No. 48,015, which describes its Type M transformer for operating stop-motion magnets with equipment used in the textile industry.

Personal Mention

Mr. Frank Stout, for many years New York manager of the Bryant Electric Company, has resigned.

Mr. William F. Woerner has resigned as member of the Public Service Commission of Missouri to give his attention to private affairs.

Mr. E. J. Bean, formerly attorney for the Public Service Commission of Missouri, has succeeded Mr. William F. Woerner as member of the same commission.

Mr. S. E. Smith has resigned as manager of the new-business department of the Atlantic City Electric Company, Atlantic City, N. J., on account of illness, and has moved to Denver, Col., in an effort to regain his health.

Mr. B. Elshoff has recently resigned his position as superintendent of the electrical department of the Canadian Westinghouse Company, Ltd., to become works manager of the Diehl Manufacturing Company, Elizabeth, N. J.

Mr. G. Masunaga, electrical engineer to the Imperial Government Railways, Tokyo, Japan, is on a tour of inspection of the electrified railways of the United States. Mr. Masunaga is interested particularly in block-signal protection for electrified tracks.

Mr. Henry Grenacher, for a number of years connected with the engineering department of H. M. Byllesby & Company, has been appointed efficiency engineer of the company to co-operate with managers of its various properties in improving their plant efficiencies.

Mr. D. S. Harris, who two years ago resigned as special representative of the Westinghouse Lamp Company to become general agent of the National District Telegraph Company, New York, has been appointed assistant to Mr. W. L. Jacoby, vice-president of the American District Telegraph Company, New York.

Mr. Oscar T. Crosby has just returned to America after spending a year abroad. He has traveled in Spain, Algeria, Tunisia, Egypt, Turkey, India, Borneo, Ceylon, the Federated Malay States, Java and Japan. He returned to the United States through China, taking the Trans-Siberian Railway to Russia. Mr. Crosby left Pekin after the war was started but found it easy to get out of Russia by way of Finland, Sweden and Denmark. From Denmark he entered Germany, and went to Holland, thence going to England. He also traveled a considerable distance in France and returned from there to England, from which he sailed.

Mr. Kempster B. Miller, of the firm of McMeen & Miller, consulting engineers, Chicago, has been appointed chief engineer for the receivers of the Central Union Telephone Company. The appointment took effect Dec. 2. Mr. Miller will continue to make his headquarters at Chicago, devoting only a portion of his time to the affairs of the receivership. The new chief engineer for the receivers of the Central Union company is widely known as a telephone engineer and as the author of the standard work "American Telephone Practice." Mr. Miller also collaborated with his partner, Mr. McMeen, on the "Telephony" series of papers on telephone engineering subjects. He is a graduate of Cornell University and prior to 1896 served on the examining staff of the Patent Office at Washington. From 1896 to 1898 he acted as chief electrician of the Western Telephone Construction Company, Chicago, and from 1899 to 1905 was engineer for the Kellogg Switchboard & Supply Company, Chicago. Since 1904 Mr. Miller has been practising as a consulting engineer under the firm name of McMeen & Miller. He is a member of the American Institute of Electrical Engineers, the New York Engineers' Club, the Chicago Engineers' Club and the Union League Club of Chicago.

K. B. MILLER

Mr. Frank E. Watts has resigned as Eastern manager of the *Electrical World*. Prior to his connection with the advertising department of this publication Mr. Watts was employed by the Western Electric Company. He is widely known in the electrical industry, being a past-Jupiter of the Jovian order. Recently he was appointed first Tribune of that order in New York.

Mr. J. W. Graham, of Twin Falls, Idaho, has been appointed to fill the vacancy left on the Idaho Public Utilities Commission by the resignation of Judge D. W. Standrod. Mr. Graham is a lawyer by profession, a native of Canada, and was educated at the University of Nebraska. The appointment which he has just accepted will hold until four years from the first Monday of January, 1914.

Mr. Ryotaro Mitsuda, electrical engineer to the Japanese Imperial Department of Communications, is visiting the United States to observe recent progress in the electrical industry. Mr. Mitsuda recently spent four weeks at the Schenectady (N. Y.) plant of the General Electric Company, and last week was in Rochester, N. Y., investigating certain features of the Rochester Railway & Light Company's underground distribution system.

Obituary

G. L. Chapin, a member of the staff of the Society for Electrical Development, Inc., died at his home in Newark, N. J., on Nov. 24 after a short acute attack of pleuro-pneumonia. For a number of years Mr. Chapin was connected with the General Electric Company, serving in its Pittsfield (Mass.) and Harrison (N. J.) works.

Douglas S. Martin.—Cable advices report the death at the Boulogne Hospital, France, from shrapnel wounds in the knee received at the battle of Messines, on the Belgian border, of Douglas S. Martin, of New York City, who left there early in August to enrol in the mounted forces of Great Britain. He was a grand-nephew of Dr. Samuel Smiles, the famous author of "Self Help," "Lives of the Engineers," etc. On Mr. Martin's graduation from the Central Technical College, London, where he studied under the late Professor Ayrton, he entered the British Thomson-Houston works at Rugby, England, and shortly afterward came to this country, in 1911, and took up the assistant editorship of the *General Electric Review* at Schenectady, soon becoming editor. Desiring to secure a fuller knowledge of the electrical arts from practical field work, particularly modern high-tension power transmission, he resigned his position in July, 1913, going to Vancouver, B. C., and then visiting the whole Pacific Coast, meantime keeping his prolific pen quite busy. Early in this year he returned East and joined the editorial staff of the *Electrical World*. He organized the more recent statistical work of this paper, constituting practically a new department, of which he remained in charge until his departure for the front. Having already served in the yeomanry and being a dashing horseman as well as a crack shot, he sought an opportunity to get to the fighting line and, to use his own phrase, "by the greatest of good luck" was drafted into the Sixteenth Lancers, which went to the war immediately. Mr. Martin was a frequent contributor to leading newspapers and magazines here and in England, and his last article, on the electric lighting of highways, appeared in the September *Engineering Magazine*. He had also a poetic faculty, and some of his verses appeared on the editorial page of the *New York Times* this summer. Mr. Martin was only twenty-seven years of age. He was a brother of Mr. T. C. Martin, secretary of the National Electric Light Association.

D. S. MARTIN

Construction

New England

PLAINFIELD, N. H.—The Public Service Commission has granted the Windsor El. Lt. Co., of Windsor, Vt., permission to supply electricity in Cornish and also to extend its transmission lines into the town of Plainfield.

BURLINGTON, VT.—The city has voted to authorize the City Council to issue $50,000 in bonds, the proceeds to be used for extensions and improvements to the municipal electric-light plant.

NORTH ATTLEBORO, MASS.—Plans have been submitted to the Electric Light Commissioners by the merchants of the town for improvements to the lighting system on Washington Street. William Plattner is superintendent of the municipal electric-light plant.

STOCKBRIDGE, MASS.—Within the next two months the Stockbridge Ltg. Co. expects to erect 2 miles of overhead distribution lines and install about ½ mile of underground distribution lines; also to purchase 5 miles of No. 6 and No. 4 insulated line wire, ½ mile of 2400-volt, twin-conductor cable and all necessary equipment for service extensions, several motors for small power consumers and two electrical pumping plants. Joseph Franz is engineer.

SURFSIDE, MASS.—Within the next four months the managers of the municipal electric-light plant expect to install one 319-hp Heine boiler, for 200-lb. working pressure, and superheater, for which contracts have already been placed. Also to purchase within the next three months shaking grates for above. H. B. Willard is manager.

HARTFORD, CONN.—The Hartford El. Co. has practically completed the erection of a 22,000-volt (steel-tower) transmission line to Unionville. A. D. Colvin is assistant general manager.

Middle Atlantic

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Dec. 7 for additions, alterations and repairs to electric equipment in the Boys' High School and in Public Schools 82, 126 and 141, borough of Brooklyn. Bids will also be received at the same time and place for installing an electric elevator in the Manual Training High School, on Seventh Avenue, between Fourth and Fifth Streets, borough of Brooklyn. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, Park Avenue and Fifty-ninth Street, borough of Manhattan, and also at branch office, No. 131 Livingston Street, borough of Brooklyn.

BUFFALO, N. Y.—Bids will be received at the office of the Department of Public Works, Room 5, Municipal Building, Buffalo, N. Y., until Dec. 10 for an electric lighting and power plant for the Porter Avenue pumping station. Plans and specifications can be seen and forms of proposals can be obtained upon application to the Bureau of Water. Francis G. Ward is commissioner of public works.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Board of Education, Park Avenue and Fifty-ninth Street, New York, until Dec. 7 for alterations and additions to the electric-light equipment in the Jamaica Training School, on Flushing and Highland Avenues, borough of Queens. Bids will also be received at the same time and place for alterations and additions to the electric equipment in Public School 15, on St. Paul's Avenue and Grant Street, Tompkinsville, borough of Richmond. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, Park Avenue and Fifty-ninth Street, borough of Manhattan, and also at branch offices, 69 Broadway, Flushing, borough of Queens, and Borough Hall, New Brighton, borough of Richmond.

POUGHKEEPSIE, N. Y.—Plans, it is reported, are under way for the organization of a stock company to furnish electricity for lamps and motors to the villages of northern Dutchess County and in the towns of Milan, Pine Plains and Stanford. The plans, it is understood, provide for the construction of a large power station on the banks of the Roeliff Jansen Kill, 4 miles north of Pine Plains, in the vicinity of Mount Ross. Chester Husted, 227 Union Street, Poughkeepsie, is interested in the company.

EASTON, PA.—An ordinance has been introduced in the City Council providing for a bond issue of $16,300, of which $4,200 will be used for extensions and improvements to the street-lighting system. The City Council has awarded the contract for the installation of the ornamental lamp standards on Northampton and Third Streets to the Macan, Jr., Co., of Easton, at $5,675. A. T. Koehler, electrical engineer, is in charge of the work.

FREEMANSBURG, PA.—The Borough Council has granted the Freemansburg El. Lt. & Pwr. Co. a franchise to supply electricity for lamps, heaters and motors in Freemansburg and adjacent territory and has also given the company a contract for lighting the streets of the borough for a period of five years. The contract calls for 26 lamps of 32 cp. A. H. S. Cantlin is president and general manager of the company.

HANOVER, PA.—The Public Service Commissioners have approved the contracts and franchises awarded on Nov. 5 by the Hanover Township Commissioners to the Luzerne County Gas & El. Co., of Plymouth. The contract calls for furnishing 150 lamps at $60 each per year for a period of 10 years. The company is also given a franchise to erect new lines and lay gas mains if needed. H. G. Williams is general manager of the Luzerne company.

STOWE, PA.—Bids will be received by H. B. Parkinson, Woodward Avenue, McKee's Rocks, Pa., for the Stowe Township School Board, of Stowe, until Dec. 7, for alterations and additions to the Davis School Building in Stowe Township. Separate bids to be submitted for general work, electric wiring, etc. Plans and specifications are on file at 46 Conestoga Building, Pittsburgh, Pa.

SOUTH ORANGE, N. J.—Estimates have been prepared for the Board of Trustees by John J. Boyd, engineer, for the installation of a municipal electric-light plant in conjunction with the local water-works, which places the cost at about $70,000, divided as follows: Power plant equipment, $12,500; conduit and manhole construction, $38,000; cables and wires, $14,250; posts, lamps and brackets, etc., $5,250.

EMORY, VA.—The Edmondson El. Co., is building a hydroelectric power plant on the Middle Fork of the Holston River near Emory, to develop about 2000 hp. Contracts, it is reported, have been placed for equipment. The company proposes to supply electricity in Emory, Chilhowie, Meadowview, Glade Spring and Abingdon. D. H. Edmondson is president.

ANACOSTIA, D. C.—Bids will be received by the Secretary of the Interior, Department of the Interior, Washington, D. C., until Dec. 15 for furnishing machinery and apparatus for remodeling pumping plant at the Government Hospital for Insane, Anacostia, taking in part payment the old machinery now in use. Copies of specifications may be obtained upon application to the chief clerk of the department.

WASHINGTON, D .C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 30 for the installation of an electric passenger elevator, hoistway, etc., in the Butler Building, Washington, D. C. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 22, for furnishing at the various navy yards and naval stations supplies as follows: Norfolk, Va., Schedule 7644—75 non-watertight buzzers, 312 interior fittings, 48 lighting fixtures with steel reflectors; Schedule 7655—miscellaneous sheet copper. Brooklyn, N. Y., Schedule 7655—miscellaneous interior communication cable; Schedule 7654—150,000 ft. double conductor wire, miscellaneous nickel-steel resistance wire, 20,500 ft. twin and single-conductor wire, 3700 galvanized steel conduit; Schedule 7650—48,800 ft. rubber-covered wire, 500 lb. weatherproof wire; Schedule 7643—miscellaneous steel boiler plate, 5400 lb. composition tubes. Washington, D. C., Schedule 7641—3800 yellow pine cross-arms, 540 chestnut telephone poles; Schedule 7646—200,000 lb. ingot copper and miscellaneous steel tubing; Schedule 7639—1000 ft. extra-strong copper pipe, miscellaneous brass tubing, 2040 lb. bronze tubing, 12,300 lb. steel tubing. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 15, for furnishing at the various navy yards and naval stations the following supplies: Brooklyn, N. Y., Schedule 7631—950 bunker lamps; Schedule 7620—3500 ft. leaded and armored interior-communication cable and single-conductor wire; Schedule 7629—1100 lb. phosphor copper, ingots of about 5 lb. each; Schedule 7626—miscellaneous cast, wrought and malleable iron pipe fittings, 6350 lb. lead pipe for lining steel tubing, 11-ft. 6-in. lengths; Schedule 7630—29,400 lb. seamless drawn-brass pipe, 12-ft. lengths, 6000 lb. seamless drawn-copper tubing, 12-ft. lengths. Bids will also be received at the same place until Dec. 22 as follows: Norfolk, Va., Schedule 7635—one motor-driven beading machine, one motor-driven, bottom flanging machine with improved lifting device, one motor-driven forming power press, one motor-driven, double-crank, back-geared power press, one motor-driven spacing punch, complete with spacing rack, one motor-driven circle and slitting shears, with traveling carriage and ways, one motor-driven squaring power shears. Philadelphia, Pa., Schedule 7633—one double direct electric-driven shear and punch. Mare Island, Cal., Schedule 7622—one 100-hp, 2200-volt induction motor (type A, Class 4). Brooklyn, N. Y., Schedule 7634—remodeling miscellaneous motor-generator sets and spare parts. Applications for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Foreign trade opportunities as announced by the Bureau of Foreign and Domestic Commerce in the Daily Consular and Trade Reports: No. 14,380—An American consular officer in southern Europe reports that an importer of electrical material of all kinds, with experience in American trade, wishes to get in touch with manufacturers of incandescent lighting mantles, fixed and adjustable supports, etc.; batteries, bells, switches, telephones, insulators, chemicals for Leclanché batteries, copper wire (plain and insulated, 0.35 mm to 0.8 mm), brass tubes, ⅜ in. to ⅝ in. in diameter, brass plates, etc. Correspondence should be in French or English. No. 14,384—A commission agent in Europe who, it is explained, has good business connections with certain mining companies in that country informs an American consular officer that he wishes to be put in touch with American manufacturers of electrical material. Catalogs and price lists should be sent at once. Correspondence should be in Spanish. No. 14,387—A business man in South America requests an American consular officer to put him in communication with American manufacturers of small electric, kerosene and gasoline motors; also portable motor plants for small boats. Correspondence may be in Spanish or English. No. 14,372—A firm established in Italy advises an American consular officer that it wishes to be put in touch with American manufacturers of electric-lighting supplies, electrically driven tools, machinery, surgical instruments, etc. Correspondence should be in Italian or French. No. 14,377—An American consular officer in the West Indies reports that a local commission merchant is interested in obtaining a small electric-light plant for a moving-picture theater. Correspondence should be in Spanish, stating export prices and terms. No. 14,522—A large firm abroad wishes to correspond with reliable firms in the United States manufacturing electric motors and accessories, lathes, tools, steel cables, etc. No. 14,528—A firm dealing in electrical machinery and supplies wishes to purchase brass pipe. No. 14,542—A foreign firm informs an American consular officer that it wishes to correspond with American manufacturers of dry batteries. No. 14,474—A South American firm wishes to get in touch with American manufacturers of electrical goods and equipment. The correspondence may be in English. No. 14,618—A merchant of high standing has requested the American consul to place him in communication with American manufacturers of dynamos, transformers, motors, switches and material for electrical installation, such as lamps and insulating tubing, electroliers, electric heaters, water boilers and general domestic appliances. Correspondence may be in English. No. 14,627—A firm abroad is desirous of communicating with manufacturers in the United States of electric glassware, flashlamps and batteries for such lamps. Further information may be obtained on application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or the following branch offices: Room 409, United States Custom House, New York, N. Y.; 629 Federal Building, Chicago, Ill.; Association of Commerce Building, New Orleans, La.; 310 United States Custom House, San Francisco, Cal.; 521 Post Office Building, Atlanta, Ga.; 1207 Alaska Building, Seattle, Wash., and 752 Oliver Building, Boston, Mass.

North Central

BATTLE CREEK, MICH.—Plans are being prepared by M. H. Morehouse, architect, 343 South Dearborn Street, Chicago, Ill., for the construction of a power plant for the Kellogg Toasted Corn Flakes Co., of Grand Rapids. The W. L. Fergus Co. has been engaged as engineer.

BAY CITY, MICH.—The Bay City Electric Light Department expects to install within the next three months a 1200-kw turbo-generator, surface condenser and steam-driven exciter; also to purchase within the next four months 500 watt-hour meters and transformers (200 kw). Williams Fitzhugh is superintendent.

BENTON HARBOR, MICH.—The Council, it is reported, has asked for bids for the installation of ornamental lamps on West and East Main Streets.

DETROIT, MICH.—Bids will be received by Messrs. Van Leyen & Schilling, 1115 Union Trust Building, Detroit, until Dec. 14 for the construction, including electric wiring, etc., of a public school building for the School District No. 10, fractional Greenfield and Springwells Township.

ISHPEMING, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 19, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Ishpeming. Drawings and specifications may be obtained at the above office or from the custodian of site at Ishpeming. O. Wenderoth is supervising architect.

JACKSON, MICH.—The Commonwealth Pwr. Co., it is reported, will supply energy to operate the new Kalamazoo-Grand Rapids interurban railway, which will be put in operation about the first of the year.

MOUNT MORRIS, MICH.—The franchise offered by the Flint El. Co., of Flint for lighting the streets of the town for a period of 30 years will be submitted to the voters at a special election to be held Dec. 5.

ATHENS, OHIO.—The City Council is considering the installation of an ornamental street-lighting system in the business section of Court Street, to be maintained by the property owners. It is also proposed to place the wires underground in this section of the city.

CUMBERLAND, OHIO—The Town Council has entered into an agreement with C. A. Vansickle for lighting the streets of the town. The contract provides for the installation of 25 street lamps of 200 cp.

GLOUSTER, OHIO. — Bonds to the amount of $4,000 have been sold to provide funds for improvements to the lighting and water systems of the town.

NORWALK, OHIO—The City Council has voted in favor of establishing a municipal electric-light plant. The proposal of the Cleveland & South Western Columbus Ry. Co. offering to supply energy to operate the proposed municipal electric-light plant and to sell such a portion of its distributing lines, equipment, etc., as the city might wish was rejected. The resolution authorizing the engaging of an electrical engineer was adopted.

WEST LIBERTY, OHIO.—The Public Utilities Commission has granted the West Liberty Lt. & Pwr. Co. permission to issue $10,000, of which the proceeds of $7,500 are to be used for the purchase of the plant of C. A. Hartzler and the remainder for improvements and extensions to system.

YOUNGSTOWN, OHIO.—The report on the municipal electric-light plant submitted by H. Whitford Jones & Co., consulting engineers, of Cleveland, has been accepted by the City Council. The report embodies a complete layout for street lighting and provides for 3400 nitrogen tungsten lamps of 100 cp for the general lighting system, while the business district is to be lighted with 243 nitrogen tungsten lamps of 1000 cp and 73 600-cp lamps to be erected on ornamental standards. The wiring for the ornamental lamps will be placed underground. The engineers recommend that negotiations be taken up with the lighting companies with a view of obtaining best prices for lighting according to these plans, and, if reasonable rates cannot be obtained, that the city proceed with the installation of a municipal electric plant and distributing system.

LOUISVILLE, KY.—The Monarch Auto Co., operating a garage at 206 East Broadway, Louisville, is contemplating installing improved equipment for charging storage batteries of electric automobiles, for both pleasure cars and trucks. The company has increased its capital stock from $10,000 to $20,000.

MIDDLEBURY, IND.—At an election to be held on Dec. 7 the proposal to light the streets of the town will be submitted to the voters.

MISHAWAKA, IND.—Bids will be received by the Board of Public Works until Dec. 14 for furnishing and erecting complete one 4,000,000-gal. horizontal, cross-compound, opposed-type crank and flywheel Corliss pumping engine, together with all necessary appurtenances in the water-works station. Plans and specifications on file in the office of George W. Nutt, clerk of board, City Hall, Mishawaka. A. R. Kline is superintendent of the municipal electric-light and water-works system.

PERU, IND.—The installation of an ornamental street-lighting system on Broadway is under consideration by the City Council.

GALESBURG, ILL.—Plans are being considered for the installation of an ornamental street-lighting system in the business district. It is proposed to erect ornamental standards carrying five-lamp clusters, the property owners to pay for installing the system and the city to maintain the lamps.

MONTICELLO, ILL.—Within the next three months the Monticello El. Lt. & Pwr. Co. expects to change over its system from 133 cycles to 60 cycles and install one 75-kw and one 150-kw generator with all switchboard apparatus. Equipment for above improvements has already been purchased. John A. Glover, of Urbana, Ill., is general superintendent.

ROCHESTER, ILL. — Negotiations are under way between the officials of the Springfield Gas & El. Co. and the Village Board of Rochester for the erection of an electric transmission line to furnish electricity for the village. The company has its lines erected to within 3 miles of the village.

BLACK CREEK, WIS.—At an election held recently the proposal to issue $7,000 in bonds for the installation of a municipal electric-light plant was carried.

EAU CLAIRE, WIS.—The cities of Red Wing, Minn., and Eau Claire, Wis., with the co-operation of the commercial bodies of those cities, have decided to establish ornamental lighting systems in their business districts. The ornamental lamps are to be erected and maintained by the Wisconsin-Minnesota Lt. & Pwr. Co., a subsidiary of the American Public Utilities Co., of Grand Rapids, Mich. The ornamental iron standards in Red Wing are to be furnished by a local firm. The ornamental iron posts in Eau Claire will be furnished by an Eau Claire foundry from patterns approved by the civic and commercial association.

MANITOWOC, WIS.—The C. Reiss Coal Co., of Manitowoc, it is reported, has purchased the franchise of the West Side El. Co., which furnishes electrical service in the west side of the city. Plans have been prepared for the erection of a large power plant on the docks owned by the C. Reis Coal Co.

AITKIN, MINN.—Bids will be received by E. A. Hanson, chairman of county board, Aitkin, until Dec. 22, for construction of county jail and sheriff's residence, to be erected in the city of Aitkin. Separate bids will be received at the same time for heating, plumbing and electric wiring and jail work. Plans and specifications are on file at the office of J. B. Lemire, county auditor, Aitkin, and C. E. Bell, Security Bank Building, Minneapolis, Minn.

HOLDINGFORD, MINN.—The Village Council has awarded a franchise to V. Herman to construct and operate an electric-light plant in Holdingford. Work has already begun on construction of the plant.

SAUK RAPIDS, MINN.—The Public Ser. Co., of St. Cloud, it is reported, is contemplating the construction of a new substation in Sauk Rapids.

NORA SPRINGS, IA.—A company, it is reported, has been organized to take over the franchise recently granted to H. W. True, of Ladysmith, Wis., to supply electricity in Nora Springs. A transmission line (8 miles long), it is understood, will be erected at once. The officers of the company are: H. W. True, president; F. W. True, vice-president and manager, and G. V. Coon, secretary.

LA PLATA, MO.—The La Plata Lt., Ht. & Ice Co. will purchase at once a rheostat for a 60-amp, 220-volt direct-current Westinghouse generator. J. M. Atkinson is resident manager.

LEXINGTON, MO.—The Missouri Gas & El. Ser. Co. expects to change its distribution system within the next four weeks from 1100 volts, single-phase, to 2300 volts, three-phase, and to install within the next six weeks one 350-kva, three-phase generating unit, directly connected. Equipment for the above has already been purchased. L. E. Marshall is manager.

LOUISIANA, MO.—The Louisiana Lt., Pwr. & Trac. Co. expects to install within the next 30 days one 16-in. by 36-in. Hamilton Corliss engine belted to a 120-kva Allis-Chalmers revolving-field generator. A. Vogel is manager.

ST. LOUIS, MO.—The Laclede Gas Lt. Co., of St. Louis, has been granted a permit to erect a power house, to cost about $20,000.

PIERRE, S. D.—The Council is contemplating the installation of cluster lamps on Pierre Street.

KANSAS CITY, KAN.—The city, it is reported, will soon ask for bids on wire, motors, heaters, etc., needed in connection with the municipal electric-light plant. A 3-mile 6600-volt line is to be erected soon, duplicating the present line.

LEAVENWORTH, KAN.—All bids submitted Nov. 13 for standards for the proposed ornamental system have been rejected by the Board of City Commissioners. It is expected that the contract for standards will be awarded to a local firm.

Southern States

DARIEN, GA.—The Darien Mfg. Co., recently incorporated with a capital stock of $40,000, it is reported, proposes to construct an ice factory and build an electric-light plant and water-works system. The incorporators are James F. Thomson, Mayor Bluestein, Robert J. Downey and Charles M. Tyson.

CHIPLEY, FLA.—Within the next two months the Chipley Lt. & Pwr. Co. expects to erect about 2 miles of line for commercial lighting. E. H. Hale is general manager.

KEY WEST, FLA.—The city of Key West will consider application for a telephone franchise from companies other than the Southern Bell Tel. & Tel. Co.

BAY MINETTE, ALA.—Bids will be received by the Mayor and Councilmen of the town of Bay Minette until Dec. 15 for furnishing materials and machinery and constructing a complete water-works system, sewer system and electric-lighting plant as follows: Electric plant consisting of one 50-kva, 1200 r.p.m., belted-type, three-phase, 60-cycle, 2300-volt generator, two-panel switchboard, exciter and about 2 miles of pole-line work complete; also construction of power house, reservoir tower and tank, 80-hp oil engine, oil tank, compressor, 750-gal. pump, 25 hydrants, about 4 miles of water mains, and 3½ miles of sewers. Plans and specifications are on file in the office of Mayor W. D. Stapleton, Bay Minette, and at the office of Edgar B. Kay, engineer, Tuscaloosa, Ala. Copies of specifications and bidding sheets may be obtained upon application to Mayor Stapleton.

CANTON, MISS.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 22 for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Canton, Miss. Drawings and specifications may be obtained at the above office or from the custodian of site at Canton. O. Wenderoth is supervising architect.

CORPUS CHRISTI, TEX.—The Texas Southern El. Co., which has recently secured a franchise to erect an electric railway between Corpus Christi and Bishop, a distance of 35 miles, contemplates the erection of a central power plant at Bishop and the construction of several connecting electric railways.

DALLAS, TEX.—Bids will be received by the Dallas County Commissioners, Charles E. Gross, auditor, Dallas, until Dec. 10 for furnishing and installing electric-lighting fixtures in the county criminal courts and jail building; also to furnish furniture in court rooms for same building. Plans and specifications may be obtained from H. A. Overbeck, architect, Dallas, upon deposit of $10.

GALVESTON, TEX.—Bids will be received by the Board of Commissioners of the city of Galveston at the office of John D. Kelley, city secretary, Galveston, until Dec. 14 for the construction of a city hall building in accordance with plans and specifications on file in the office of the city secretary, City Hall, Galveston.

Pacific States

RIVERSIDE, WASH.—Application has been made to the Council by J. K. Norris, of the Riverside Lumber & Box Co., for a franchise to install an electric-light system in Riverside.

UNION, ORE.—The City Council has signed a new contract with the Eastern Oregon Lt. & Pwr. Co. for street lighting. The new contract calls for the installation of new street lamps.

FRESNO, CAL.—The Fresno Interurban Ry. Co. has applied to the State Railroad Commission for permission to issue $212,500 in capital stock and $350,000 in bonds, the proceeds to be used for the construction of an electric railway 26 miles long, one branch of which will run from Fresno to the Centerville citrus district, and the other from Fresno to the Clovis and Gould colony.

LOS ANGELES, CAL.—The State Railroad Commission has granted the Southern California Edison Co., of Los Angeles, permission to issue $784,000 in bonds, of which $266,000 may be sold at once at not less than 86.

LOS ANGELES, CAL.—The city of Los Angeles has filed a petition with the State Railroad Commission asking for an appraisal preliminary to a condemnation of the distributing system of the Southern California Edison Co. The system is desired by the city for the purpose of distributing electricity from its aqueduct generating plant. The proceeds of the $6,500,000 bond issue voted last spring will be used to purchase the system.

OROVILLE, CAL.—The Oro El. Corpn. has applied to the Supervisors of Trinity County for a franchise to erect transmission lines in Trinity County. Bids for the above franchise will be received until Jan. 7, 1915.

SAN FRANCISCO, CAL.—The Coast Valleys Gas & El. Co., of San Francisco, has filed an application with the State Railroad Commission asking permission to issue $100,000 in bonds, the proceeds of $69,392 to be used to reimburse the company for additions and improvements already made and the remainder for further construction work.

RUPERT, IDAHO.—Within the next six months the Rupert El. Co. expects to purchase from 50 to 75 air heaters and a switchboard capable of handling 1000 amp at 220 volts, complete with switches and fuses. F. N. Victor is president.

EUREKA, UTAH.—The Utah Pwr. & Lt. Co. is installing a new street-lighting system in Eureka. The company is also making extensive improvements to its system in Tintic.

BOZEMAN, MONT.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 2, for construction, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Bozeman, Mont. Drawings and specifications may be obtained at the above office or from the custodian of site at Bozeman. O. Wenderoth is supervising architects.

MONDAK, MONT.—A company, it is reported, is being organized to construct and operate an electric-light plant in Mondak. Ground has already been broken for the power house.

LA JUNTA, COL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Jan. 4, 1915, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at La Junta. Drawings and specifications may be obtained at the above office or from the custodian of site at La Junta. Col. O. Wenderoth is supervising architect.

STEAMBOAT SPRINGS, COL.—Within the next 12 months the Steamboat Ser. Co. expects to purchase a car load of poles and 3 miles of No. 8 weather-proof wire. W. E. Carver is secretary.

Canada

DELAWARE, ONT.—The Village Council is contemplating the installation of an electric system to supply electricity for street-lighting, commercial and industrial purposes.

MOUNT BRYDGES, ONT.—At an election held Nov. 23 the by-law providing for securing electricity from the Hydro-Electric Power Commission was carried.

NEWMARKET, ONT.—The Town Council has decided to call an election on Jan. 15, 1915, to submit the by-law to authorize an issue of $15,000 in debentures for the construction of a substation and the extension of the Hydro-Electric Power Commission service into the municipality.

NIAGARA FALLS, ONT.—The electric light committee, it is understood, will soon call for bids for the installation of the proposed new street-lighting system.

OTTAWA, ONT.—Tenders will be received by R. C. Desrochers, secretary Department of Public Works, Ottawa, until Dec. 9, for the installation of one standard freight elevator in the Ottawa post office. Plans, specifications and form of tender may be obtained on application to the Department of Public Works, at the offices of Thomas A. Hastings, clerk of works, postal station "F," Toronto, Ont., and R. L. Deschamps, superintendent of public buildings, Montreal, Que.

SHELBURNE, ONT.—The proposal to secure energy from the Hydro-Electric Power Commission of Ontario has been approved by the rate-payers.

TORONTO, ONT.—Bids will be received by the advisory industrial committee of the Board of Education, addressed to W. C. Wilkinson, secretary and treasurer of board, Toronto, until Dec. 11, for power-plant equipment for the new central technical school on Lippincott Street, Toronto, consisting of steam engines, generators, switchboard, steam piping and electrical connections. Plans and specifications may be obtained at the office of the Canadian Domestic Engineering Co., 47-51 King Street, engineer.

WINDSOR, ONT.—The City Council has passed a by-law authorizing an additional issue of debentures to the amount of $75,000 for the installation of the Hydro-Electric system in Windsor. The original estimate was $100,000, but owing to the growth of the city many miles of additional wiring and pole lines will have to be erected. This expenditure will not cover the cost of the street-lighting system, but will provide for the distributing system, the power lines and the service wires within the city.

Miscellaneous

PEARL HARBOR, HAWAII—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 12 for furnishing three electric traveling shop cranes at the naval station, Pearl Harbor, Hawaii. Plans and specifications may be obtained on application to the above bureau. H. R. Stanford is chief of bureau.

PANAMA.—Bids will be received at the office of the general purchasing officer of the Panama Canal, Washington, D. C., until Dec. 14 for furnishing wire cables and attachments, cable clips, turnbuckles, steel rolling doors, etc. Blanks and general information relating to this circular (No. 880) may be obtained at the above office or from the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is general purchasing officer.

New Incorporations

DOVER, DEL.—The Ohio & Western Utilities Co. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $7,500,000. The company proposes to establish and operate utilities in any state. The incorporators are: E. Hawley Van Wyck, Crawford, N. J.; Albert and A. Bridgeman, of St. George, Staten Island, and L. M. Symmes, of Brooklyn, N. Y.

BALTIMORE, MD.—The General Utilities & Operating Co. has been organized with a capital stock of $1,500,000. The company has acquired the Logan County Lt. & Pwr. Co., of Logan; also the plants at Merryville and Rockford, Tenn., and proposes to purchase other public utilities in the South. The officers are: J. C. M. Lucas, president; D. F. Mallory, vice-president, and Francis R. Weller, Hibbs Building, Washington, D. C., general manager and engineer. The office of the company is at 1422 Munsey Building, Baltimore, Md.

GETTYSBURG, PA.—The Oxford Township Lt., Ht. & Pwr. Co., of Gettysburg, has been incorporated with a capital stock of $5,000. The incorporators are Norman S. Meindel, Raymond F. Topper and J. Donald Swope, all of Gettysburg.

RICHLANDS, VA.—The Richlands Service Corpn. has been incorporated with a capital stock of $25,000 to construct and operate electric and gas plants. The officers are: A. M. Mann, of Big Stone Gap, Va., president, and W. E. Pelton, of Cincinnati, Ohio, vice-president and secretary.

Directory of Electrical Associations

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, H. O. Hanson, Mobile Gas Co., Mobile, Ala.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Permanent secretary, L. O. Howard, Smithsonian Institution, Washington, D. C. Annual meeting, Philadelphia, Dec. 26, 1914, to Jan. 2, 1915.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary-treasurer, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, E. B. Burritt, 29 West 39th St., New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary, Eugene W. Stern, 101 Park Ave., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country.

AMERICAN PHYSICAL SOCIETY. Secretary, Prof. A. D. Cole, Ohio State University, Columbus, Ohio.

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS. Secretary, William H. Ross, 154 Nassau St., New York City.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, Edgar Marburg, University of Pennsylvania, Philadelphia.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Secretary, Edwin A. Scott, 29 West 39th St., New York.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 47 State St., Troy, N. Y.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Assistant secretary, Walter Neumuller, Irving Place and 15th St., New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, W. T. Snyder, McKeesport, Pa.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago.

CALIFORNIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. S. Hanbridge, 1408 Merchants' National Bank Building, Los Angeles, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary-treasurer, Alan Sullivan, 610 Confederation Life Bldg., Toronto, Can.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Col.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, T. F. Kennedy, 900 15th St., Denver, Col.

COMMERCIAL SECTION, N. E. L. A. Secretary, J. F. Becker, 1170 Broadway, N. Y.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, C. S. Van Dyck, Schenectady, N. Y.

ELECTRIC CLUB OF CHICAGO. Secretary, Howard Ehrlich, 608 South Dearborn St., Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER BOSTON. Secretary, R. S. Hale, 39 Boylston St., Boston.

ELECTRICAL CONTRACTORS' ASSOCIATION OF MASSACHUSETTS. Secretary, H. D. Temple, 30 Foster St., Worcester, Mass.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russel, Jr., 25 West 42d St., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF THE CITY OF CHICAGO. Secretary, M. N. Blumenthal, 179 West Washington St. Meets at noon on the second and fourth Wednesday of each month at 424 South Wabash Ave.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, A. J. Burns, 318 West Tenth St., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, 626 Lloyd St., Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary, John W. Crum, 1324 Land Title Building, Philadelphia, Pa.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago, Ill.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next meeting, Birmingham, Ala., Dec. 8-10.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Executive secretary, A. Jackson Marshall, 29 West 39th St., New York. Sections in New York, New England, Chicago, Philadelphia, Washington and Los Angeles.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York. Midyear, meeting, Albany, N. Y., Dec. 10 and 11.

FARADAY ELECTRICAL ASSOCIATION. Secretary, W. J. Collins, 1129 Masonic Temple, Chicago. Meets at noon on the first and third Wednesday of each month at Planters' Hotel.

FRANKLIN INSTITUTE. Secretary, Dr. R. B. Owens, Philadelphia, Pa.

GAS, ELECTRIC AND STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-treasurer, Prof. H. V. Bozell, Norman, Okla.

GEORGIA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. M. Clayton, Atlanta, Ga.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, C. A. Littlefield, 29 West 39th St., New York.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y.

INDEPENDENT TELEPHONE ASSOCIATION OF AMERICA. Secretary, W. S. Vivian, 19 South LaSalle St., Chicago. Annual meeting, Minneapolis, Minn., Jan. 19-21, 1915.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donahue, Lafayette, Ind.

INDIANA STATE ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, George Skilman, Indianapolis, Ind.

INSTITUTE OF OPERATING ENGINEERS. Secretary, L. Houmiller, 29 West 39th St., New York.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 71 Broadway, New York.

INTERNAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 West Indiana St., Chicago. Meeting second Friday of each month at Lewis Institute.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ENGINEERING CONGRESS. Secretary-treasurer, W. A. Cattell, Foxcroft Building, San Francisco, Cal. Congress, San Francisco, September, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Meeting at San Francisco, Sept. 9-11, 1915.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Secretary, W. H. Thomson, Des Moines, Ia.

IOWA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, M. T. Humphrey, Waterloo, Ia.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

JOVIAN ORDER. Jupiter (president), Homer E. Niesz, Chicago, Ill.; Mercury (secretary), E. C. Bennett, Syndicate Trust Building, St. Louis, Mo.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary-treasurer, Ivor Thomas, 237 South Main St., Wichita, Kan.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, J. J. Ziegler, 227 Bourbon St. Meeting every Wednesday, Audubon Building, New Orleans.

MAINE ELECTRIC ASSOCIATION. Secretary-treasurer, Walter S. Wyman, Waterville, Maine.

MICHIGAN ELECTRIC ASSOCIATION. Affiliated with N. E. L. A. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

MINNESOTA ELECTRIC ASSOCIATION. Secretary-treasurer, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Affiliated with the National Electric Light Association. Secretary-treasurer, H. F. Wheeler, Hattiesburg, Miss. Next annual meeting, Hattiesburg, April 12-14, 1915.

MISSOURI ELECTRIC, GAS, STREET RAILWAY AND WATER WORKS ASSOCIATION. Secretary-treasurer, F. D. Beardslee, Union Electric Light & Power Co., St. Louis.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, Wm. L. Smith, Concord, Mass.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, George H. Duffield, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Open meeting, New York, March, 1915.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, J. B. Earle, Waco, Tex.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, S. J. Bell, David City, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass.

NEW ENGLAND SECTION, ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Secretary, L. L. Edgar, 39 Boylston St., Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, H. A. Faulkner, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND SECTION, N. E. L. A. Secretary, Miss O. E. Bursiel, 149 Tremont St., Boston, Mass.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings second and fourth Tuesday of each month.

NEW YORK ELECTRIC RAILWAY ASSOCIATION. Secretary, Charles C. Dietz, 365 East 21st St., Brooklyn, N. Y.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Affiliated with the National Electrical Credit Association. Secretary, Franz Neilson, 80 Wall St., New York.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NORTHWEST SECTION, N. E. L. A. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

NORTHERN WHITE CEDAR ASSOCIATION. Secretary, R. N. Boucher, 743 Lumber Exchange, Minneapolis, Minn.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio.

OREGON ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, F. C. Green, 291 East Morrison St., Portland, Ore.

PENNSYLVANIA ELECTRIC ASSOCIATION (State Section N. E. L. A.). Secretary-treasurer, H. N. Müller, Pittsburgh, Pa.

RAILWAY SIGNAL ASSOCIATION. Secretary-treasurer. C. E. Rosenberg, Times Building, Bethlehem, Pa.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, 29 West 39th St., New York.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa. Annual meeting, Ames, Ia., June 22-25, 1915.

SOUTHEASTERN SECTION, N. E. L. A. Secretary-treasurer, Geo. H. Wygant, Tampa, Fla.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer. C. H. West, Rutland, Vt.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Annual meeting, Minneapolis, Minn., Jan. 26-28, 1915.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, George Allison, 1410 First National Bank Building, Milwaukee, Wis. Annual meeting, Milwaukee, Jan. 18-20.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 24, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,117,965. LAMINATED BRUSH FOR ELECTRICAL MACHINES AND METHODS OF MAKING THE SAME; O. E. Becker, Chicago, Ill. App. filed May 2, 1912. Carbon plates coated with copper and fused into a solid block which is cut at an oblique angle to the laminations.

1,118,004. ART OF TRANSMITTING SOUNDS BY MEANS OF HERTZIAN WAVES; W. Harrison, New York, N. Y. App. filed March 11, 1902. Employs an ultra-violet light.

1,118,024. ELECTRICAL SWITCH; J. H. Lawrence, Covington, Ky. App. filed Aug. 27, 1913. Permutation type; for automobile ignition circuits.

1,118,035. CONDUCTOR CABLE SUPPORT; W. F. Meschenmoser, New Dorp, N. Y. App. filed Nov. 22, 1911. For supporting vertical trunk line cables; special form of clamping bushing.

1,118,064. ELECTRIC PROTECTION SYSTEM; W. M. Scott, Radnor, Pa. App. filed March 25, 1912. For protecting a generator running in parallel with another generator.

1,118,099. BATTERY-CHARGING SYSTEM; C. E. Beach, Binghamton, N. Y. App. filed Sept. 2, 1913. Controlled according to condition of battery and also by time-control mechanism.

1,118,100. TROLLEY STAND; F. W. Bishop, Cleveland, Ohio. App. filed July 19, 1911. Current taken off by arm pivoted centrally to the rotatable member of the trolley stand.

1,118,105. TROLLEY DEVICE; S. H. Coyne, Syracuse, N. Y. App. filed July 12, 1907. For raising trolley pole and lowering it when trolley leaves the wire.

1,118,120. SELECTIVE SIGNALING DEVICE; M. F. Geer and R. C. Leake, Rochester, N. Y. App. filed Dec. 8, 1910. Magnets operate sectors which control circuit.

1,118,121. PROTECTING SEAL; C. A. Gillingham, Lakewood, Ohio. App. filed April 27, 1914. For flashlamp cells.

1,118,172. METHOD OF REPRODUCING ELECTRICAL VARIATIONS; H. de F. Arnold, Belleville, N. J. App. filed July 15, 1912. Amplifies without distortion.

1,118,173. ELECTRIC RELAY; H. de F. Arnold, Belleville, N. J. App. filed July 15, 1912. For amplifying voice currents originating in an incoming circuit.

1,118,174. ALTERNATING-CURRENT GENERATOR; H. de F. Arnold, East Orange, N. J. App. filed June 12, 1913. For generating undamped high-frequency alternations or oscillations.

1,118,175. ELECTRIC-RELAY APPARATUS; H. de F. Arnold, East Orange, N. J. App. filed Jan. 8, 1914. Of the gaseous type.

1,118,176. NEGATIVE RESISTANCE REPEATER; H. de F. Arnold, East Orange, N. J. App. filed May 7, 1914. Secures amplified reproductions of variations of current energy without distortion of wave-form.

1,118,188. ELECTRIC SWITCH; J. Desmond, Chicago, Ill. App. filed March 25, 1912. Automatic; for air-compressor motor.

1,118,219. SOUND-RECORDING APPARATUS; J. Noll, New York, N. Y. App. filed Feb. 3, 1914. Automatically records the message at a telephone station.

1,118,228. OSCILLATION DETECTOR; G. W. Pickard, Amesbury, Mass. App. filed Aug. 20, 1910. Conducting compound of sulphur not containing copper and a conducting solid of oxide of zinc in electrical contact therewith.

1,118,230. TELEPHONIC INSTRUMENT; G. R. Preusse, New York, N. Y. App. filed Nov. 18, 1912. Gives loud-voiced or low-toned annunciation in control of person receiving the message.

1,118,256. SWITCH; C. J. Anderson, Chicago, Ill. App. filed March 3, 1911. Solenoid-operated multiple switch for alternating-current motors.

1,118,269. MEANS FOR UTILIZING WASTE ENERGY; J. L. Creveling, Wilmington, N. C. App. filed Jan. 10, 1906. Thermo-electric generator operates by heat from engine exhaust and is used to supply ignition current.

1,118,270. FISH-WIRE REEL; B. Dahl, Minneapolis, Minn. App. filed July 17, 1913. For threading wires through conduits and then by reverse rotation drawing cable through conduits.

1,118,283. CARRIER-PIGEON SIGNALS; R. H. Holdefer, Baltimore, Md. App. filed May 25, 1914. Signals arrival of pigeon at the end of its flight.

1,118,296. ACCELERATING DEVICE FOR ALTERNATING-CURRENT MOTORS; W. D. Lutz, Allendale Borough, N. J. App. filed Jan. 7, 1911. Frequency changer controls successive operation of the circuit controllers.

1,118,311. AUTOMATIC RAILROAD BLOCK SYSTEM; P. J. Simmen, Berkeley, Cal. App. filed June 3, 1907. Single-track road with separate signals for incoming and outgoing trains.

1,118,320. ELECTRIC WATER-HEATING FAUCET; E. C. Webster, East Oakland, Cal. App. filed Nov. 11, 1913. Can deliver either cold or hot water.

1,118,324. ELECTRIC SWITCH; H. H. Berry and W. J. Markham, London, Eng. App. filed Sept. 16, 1913. Armor-clad type.

1,118,328. TEMPERATURE REGULATOR; C. R. Burlew, Yonkers, N. Y. App. filed Nov. 26, 1912. For controlling furnace drafts.

1,118,332. AMMONIA-SODA PROCESS; A. Clemm, Manheim, Germany. App. filed July 24, 1913. Expels the ammonia by heat and electrolyzes the remaining concentrated solution of sodium chloride.

1,118,333. ELECTRIC REGULATOR; J. L. Creveling, New York, N. Y. App. filed March 16, 1910. For maintaining voltage constant in a circuit.

1,118,336. CAR TRUCK; O. E. Edwards, Jr., New York, N. Y. App. filed March 31, 1914. Bolster carried through the combined action of a leaf spring and a coil spring.

1,118,340. TRANSMITTER BRACKET; A. F. F. Gilson, Closter, N. J. App. filed Dec. 15, 1911. Made of sheet metal.

1,118,371. ELECTRIC LOCOMOTIVE; B. Schottelius, Berlin, Germany. App. filed Oct. 21, 1913. Gears on the jack-shaft are resiliently mounted.

1,118,380. VAPOR-ELECTRIC DEVICE; W. E. Story, Jr., Schenectady, N. Y. App. filed May 10, 1913. Maintains the anodes uniformly heated.

1,118,382. PROPELLING SHIPS BY POLYPHASE ELECTRIC CURRENT; E. Thompson, Swampscott, Mass. App. filed Jan. 16, 1911. Turbines drive polyphase generators of the induction type which supply current to the polyphase induction motors on the propeller shafts.

1,118,387. ELECTRICAL-HEATING DEVICE; E. Weintraub, Lynn, Mass. App. filed Oct. 16, 1913. For furnaces operating in air up to 1300 deg. C., core of tungsten and a shell of silicon in close contact therewith.

1,118,392. ELECTRIC-COOKING DEVICE; H. P. Ball, Pittsfield, Mass. App. filed Nov. 26, 1912. Range with heat-insulated cooking pocket sunk below the top surface thereof.

1,118,399. ELECTRODE; J. T. H. Dempster, Schenectady, N. Y. App. filed May 20, 1904. Magnetite and titanium oxide with small amount of chromium oxide.

1,118,400. ELECTRODE; J. T. H. Dempster, Schenectady, N. Y. App. filed May 20, 1904. Magnetite and titanic material with an addition of chromite.

1,118,402. ELECTRIC INCANDESCENT LAMP; F. Dickenschied, Berlin, Germany. App. filed July 15, 1912. Filament supported in a special arrangement.

1,118,408. ARC LAMP; R. Fleming, Lynn, Mass. App. filed Sept. 22, 1906. Control of the consuming and non-consuming electrodes.

1,118,410. COHERER; C. A. Glass, Greensburg, Kan. App. filed June 9, 1908. Has a rotatably supported cup containing loose coherer particles.

1,118,414. FLAME-ARC LAMP; C. A. B. Halvorson, Jr., Saugus, Mass. App. filed Dec. 27, 1909. Has pairs of parallel carbons arranged on converging lines.

1,118,416. VEHICLE SIGNAL; J. B. Hawks and H. R. Kennedy, Los Angeles, Cal. App. filed Nov. 19, 1913. Push-button-controlled solenoids turn semaphores into signaling positions.

1,118,418. ELECTRICAL TERMINAL DEVICE; R. H. Henderson, East Orange, N. J. App. filed Dec. 5, 1910. For preparing tungsten filaments; receptacles filled to overflowing with mercury and heated.

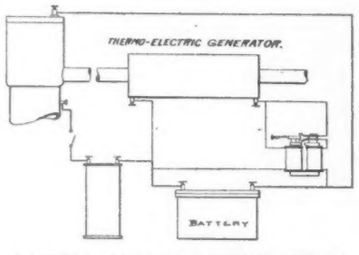
1,118,422. ELECTRIC MASTER CLOCK; A. Jabs, Zurich, Switzerland. App. filed May 5, 1914. Special arrangement of the contacts controlling the secondary clocks.

1,118,433. COMPENSATING WINDING FOR POLYPHASE COMMUTATOR MACHINES WITH DRUM ARMATURES; H. Meyer-Delius Baden, Switzerland. App. filed March 24, 1910. Has a two-part drum winding.

1,118,444. MAXIMUM-DEMAND INDICATOR; L. T. Robinson, Schenectady, N. Y. App. filed May 22, 1913. Accurately measures the maximum demand in a manner satisfactory to both consumer and central station.

1,118,446. INSULATING COIL; H. Roos, Charlottenburg, Germany. App. filed Sept. 17, 1912. Made of turns of flat conductor with interposed sheets of insulation.

1,118,454. ELECTRIC-COOKING APPARATUS; H. G. Weeks, Chicago, Ill. App. filed May 6, 1911. Range capable of economically carrying on all cooking operations of ordinary household.



1,118,269—Means for Utilizing Waste Energy

1,118,464. ARC-LAMP ELECTRODE; M. H. Baker, Boston, Mass. App. filed Oct. 22, 1909. Feed-regulating strip secured thereto and reinforced along its exposed edge.

1,118,467. PISTOL FLASHLIGHT; J. Block, Brooklyn, N. Y. App. filed June 10, 1913. Has a trigger carrying a contact bridging between the battery cell and lamp-end contact.

1,118,490. AUTOMATIC TELEPHONE SYSTEM; D. S. Hulfish, Toronto, Ontario, Canada. App. filed March 23, 1911. During connection with trunk line a station is guarded from interference by any other substation.

1,118,520. AIR BRAKE; G. B. Wolf, San Antonio, Tex. App. filed June 7, 1912. Has solenoid-operated controlling valves.

1,118,525. AUTOMOBILE SIGNAL; G. W. Barringer, Lawrence, N. Y. App. filed June 4, 1913. Has a telltale on dash to indicate condition of the rear signal.

1,118,545. WIRE CLAMP FOR INSULATORS; C. Giovannoni, Enterprise, Ore. App. filed Jan. 12, 1914. Wire-clamping plates having an adjustable connection with the insulator.

1,118,571. AIR AND ELECTRIC COUPLING FOR RAILROAD TRAINS; B. C. Nelson, Oakland, Cal. App. filed Dec. 27, 1912. Can be coupled without kneeling between the cars.

1,118,608. TIME-ELEMENT DEVICE; N. Wilkinson, Milwaukee, Wis. App. filed April 17, 1911. Thermostat bars arranged in the form of a truss and forming with their common base a triangle.

1,118,616. POWER-TRANSMISSION DEVICE; V. G. Apple, Dayton, Ohio. App. filed Nov. 9, 1912. Motor-generator for automobile starting and lighting; cannot be operated as starting motor when engine has been left in gear.

1,118,623. ELECTRIC-LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Jan. 31, 1912. Has a coiled lamp-engaging spring which prevents the lamp being shaken loose from the socket.

1,118,632. AUTOMATIC VOLTAGE REGULATOR SYSTEM; G. A. Burnham, Essex, Mass. App. filed Aug. 23, 1909. Regulating transformer and means to vary periodically its primary circuit automatically.

1,118,633. AUTOMATIC VOLTAGE REGULATOR; G. A. Burnham, Cliftondale, Mass. App. filed July 16, 1910. Make and break device constantly operates to shunt a moderate field resistance.

1,118,650. PRINTING-TELEGRAPH ALPHABET; D. S. Hulfish, Toronto, Ontario, Canada. App. filed April 20, 1911. Alternating-current system.

1,118,655. CALLING DEVICE; W. Kaisling, Chicago, Ill. App. filed July 25, 1910. For automatic and semi-automatic telephone systems.

1,118,678. ELECTRICAL MEASURING INSTRUMENT; J. Patrick, Detroit, Mich. App. filed March 2, 1911. Special electromagnetic restoring means.

1,118,684. ELECTRIC-ARC LAMP; M. A. Ross, Chicago, Ill. App. filed May 19, 1913. Improved holder for lower electrode of a fixed focus lamp.

1,118,694. DISK STRAIN INSULATOR; L. Steinberger, Brooklyn, N. Y. App. filed Jan. 3, 1913. Has ridges arranged to reinforce the structure.

1,118,699. PERMUTATION ELECTRIC SWITCH; G. Stupar, Chicago, Ill. App. filed Aug. 28, 1913. Has a longitudinally movable switch-controlling stem.

1,118,717. ELECTRIC INDICATOR; J. W. Wiley and J. A. Kropp, Oak Park, Ill. App. filed July 30, 1912. For keeping record of time spent by employees on particular jobs of work.

1,118,731. RAIL BOND; J. R. Bowers, J. A. Potter and C. B. Darnell, Newburg, Mo. App. filed June 20, 1913. Rail bond is severed upon excessive separation of the rail ends.

1,118,742. SPEEDOMETER ATTACHMENT; A. E. Cole, Forest, Ill. App. filed Nov. 5, 1913. Sounds alarm at predetermined speed.

1,118,763. ELECTRIC STOVE; W. V. Hardy, Indianola, Miss. App. filed Aug. 19, 1914. Particularly for heating press boxes.

1,118,765. FLECTRICAL SIGN; T. S. Hastings, Detroit, Mich. App. filed May 29, 1913. For representing line drawings of script in process of formation.

1,118,780. TELEPHONE TRANSMITTER; A. D. Jones, Philadelphia, Pa. App. filed May 7, 1914. Prevents packing of the carbon granules.

1,118,812. PRODUCTION OF GAS-TIGHT SEALS OR CLOSURES BETWEEN METAL AND VITREOUS MATERIAL; H. J. S. Sand, Nottingham, and F. Reynolds, London, Eng. App. filed Jan. 30, 1914. Applies lead under non-oxidizing conditions.

1,118,847. ATTACHMENT FOR TROLLEY HARPS; W. Eggers, Baltimore, Md. App. filed Nov. 11, 1913. Guard supported wholly from the axis of the trolley wheel.

1,118,868. METALLIC-VAPOR LAMP; F. Kerschbaumb, Cambridge, Eng. App. filed Sept. 8, 1913. Obtains light free from the effect of absorption by radial magnets.

1,118,872. ELECTRIC IRON; W. S. Lyle, Jr., San Francisco, Cal. App. filed May 18, 1914. Has an indicator lamp on the handle thereof.

1,118,878. COATING FLEXIBLE OBJECTS OF ORGANIC ORIGIN WITH METAL; R. Rafn, Nuremberg, Germany. App. filed Oct. 17, 1914. Uses a coat of drying oil that fixes the metallic dust upon the surface.

1,118,891. TRAIN-CONTROL SYSTEM; J. Ames, Montrose, Ia. App. filed July 1, 1912. Circuit arrangement for insulated block system.

1,118,900. MERCURY-TUBE SWITCH; T. B. Freas, New York, N. Y. App. filed Jan. 4, 1912. Special mounting of contact needle, filler duct, etc.

1,118,905. SEAL FOR VAPOR-ELECTRIC APPARATUS; R. D. Mailey, Lynn, Mass. App. filed March 6, 1913. Made flexible.

1,118,906. MANUFACTURE OF ELECTRICAL RESISTANCES; A. W. Maley, Handsworth, Birmingham, Eng. App. filed Oct. 8, 1910. Made of soft iron; case hardened to give rigidity.

1,118,910. AUTOMATIC TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Oct. 13, 1910. Metallic line system.